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## Construing Natural Restorative Environments in Individuals Treated for Cancer

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Graduate Program in Health and Rehabilitation Sciences  
A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy  
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CONSTRUING NATURAL RESTORATIVE ENVIRONMENTS IN INDIVIDUALS  
TREATED FOR CANCER

(Thesis format: Monograph)

by

Adam Michael Bryson Day

Graduate Program in Health and Rehabilitation Sciences

A thesis submitted in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy

The School of Graduate and Postdoctoral Studies  
The University of Western Ontario  
London, Ontario, Canada

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## Abstract

Restorative environments (RE) are increasingly being explored for their potential to foster psychophysiologic restoration and promote health and well-being. However, there is a paucity of research that focuses on oncology populations. The purpose of this study was to explore whether individuals treated for cancer with chemotherapy construed natural restorative environments (NREs) differently than age- and gender-matched individuals never treated for cancer. Fifteen individuals treated for cancer with chemotherapy (11 females and 4 males; treatment group) and 15 age- and gender-matched individuals (comparison group) participated in interviews and completed repertory grids based on construing NREs. Constructs were elicited directly from participants based on 10 standard a priori elements of natural settings, as well as an eleventh ideal NRE that was generated by each participant based on their preferences. Additionally, participants rated elements according to a standard construct defined as *overall restorative—overall not restorative*. Repertory grid data were analyzed both ideographically and nomothetically. Idiographic analyses indicated that while variation existed in the way NREs were construed, there were important similarities that indicated individual data could be aggregated. Subsequent nomothetic analyses revealed few differences in how individuals in either group construed NREs. Overwhelmingly, an ideal NRE was described as wild or remote natural environment that included a vista and water. The degree of naturalness was ultimately found to be the most important factor in predicting the restorative potential of a given natural environment, followed by interpretations of structure and the presence of water. Given that no differences were found between groups relative to how NREs were construed, it was determined that the experience of cancer and chemotherapy did not meaningfully impact the way participants in this study construed NREs. Therefore, it is anticipated that research and practice in the RE field that primarily targets healthy populations could be translated to oncology contexts with little difficulty. Given that individuals experiencing ill-health and disability secondary to cancer may stand to benefit meaningfully from restorative experiences with nature, fostering connections with nature and the environment in these contexts should be a future area of focus in the RE field.

## Keywords

Nature, restorative environments, restoration, chemotherapy, oncology, health, well-being, repertory grid, personal constructs



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## Chapter 1

*Is the love of seasons only poetry... ?*

Paul Shepard

*Look at Mother Nature on the run in the nineteen seventies.*

Neil Young

**H**umans are of nature; it is at our essence, and humans and nature are inextricably linked. The lives of the earliest humans were fundamentally reliant on nature and elements of the natural environment, and for only the very briefest period in our history, has the potential existed for humans to live in near total isolation from nature and the environment (Shapiro & Kaplan, 1998). In the case of our earliest ancestors, humans were wholly reliant on the natural environment for food, shelter, and resources (Shepard, 1991). Today, relationships between nature and the average citizen in developed nations often exist within the scope of leisure and recreation. In comparison, early humans would have been forced to live in harmony with their surrounding natural environment as a matter of survival. Later, as early civilizations emerged from smaller communities and the "built" environment evolved, it became possible to separate oneself from the natural environment at increasing degrees.

However, examples of integrated nature in ancient built spaces are common. For instance, Shepard (1991) discusses the evolution of nature and parks in human society, including many examples how nature was integrated into the everyday lives of ancient citizens. For example, Shepard highlights hanging gardens in ancient Persia and private gardens in ancient Egypt, and their role in the evolution of the "vacation." As well, he describes public and private parks and gardens in ancient Greece, and in early Christian and medieval times he notes the emergence of "city" parks as a part of everyday environments (Shepard, 1991). Moreover, in the context of



health and well-being, Davis (1998) speaks about how physicians during the time of Christ were aware that gardens were helpful for their “quieting” effect, and Detweiler, Sharma, Detweiler, Murphy, Lane, Carman et al. (2012) discuss that using horticulture to calm the senses was practiced by the Mesopotamians. Additionally, Cooper Marcus and Barnes (1999) described how places for healing were often located in natural settings, while Lewis (as cited in Davis, 1998) has discussed how early Egyptian physicians would recommend garden walks for royalty experiencing mental illness. Similarly, Sachs (1999) notes that physicians were integrating outdoor recreation in treatment plans as early as the fifteenth century. Overall, it has been commonly recognized across the majority of our civilized history that natural settings and contact with nature were beneficial. In fact, only for a relatively brief period of time have we removed ill individuals from natural settings and placed them in unnatural, sterile hospital environments. Indeed, the tides are changing and there is an increasing awareness of, and resurgence in efforts which seek to design healing spaces with nature and nature contact in mind (see for example, Cooper Marcus & Barnes, 1999; Ulrich et al., 2008). This resurgence is important for myriad reasons limited not only to nature conservation. For instance, the potential that contact with nature could promote health is important given the multidimensionality of health, illness, and well-being (Frumkin, 2001).

This dissertation was designed to explore human-nature-health relationships and how fostering connections with nature might promote human health and well-being. To begin, the essence of human-nature relationships will be explored relative to contemporary thought on human relationships with nature, followed by a survey of the theoretical positions that inform my work and the evidence that supports it. Next, the theoretical framework that grounds this investigation and its methodology will be outlined. Last, a rationale for this study will be built that problematizes individual experiences of cancer treatment and discusses why fostering connections with nature might provide simple, yet important benefits to well-being.

## 1.1 Operationalizing “Nature”

First and foremost, it is pertinent to operationalize the terms “nature” and “natural environment,” and to contextualize how they will be used herein. The terms “nature” and

“natural environment” will be used interchangeably, referring to any part of the natural world. These terms will not be restricted to specific elements of the natural world, but instead all parts of it, including any plant life and flora from grass to trees, and forests to gardens to potted plants, as well as geographical landforms and bodies of water of any size. I have purposefully operationalized these terms with such a wide scope as to reflect my position that a connection with nature is independent of scale. By this I intend to convey that a meaningful connection with nature is defined by the purpose and outcome of the connection, not the physical metrics of magnitude, volume, or quantity. For instance, a moment with a houseplant *may* be no different than sitting on a rocky outcrop on the edge of a lake in the middle of a great forest, provided the end result reinforces a meaningful or purposeful human-nature connection. I believe this distinction to be important, and argue that a meaningful connection with nature is contextualized by the needs of the individual in a given moment, in a given time and space, and based on his or her personal history and experiences. As needed, salient examples of nature or the natural environment will be used to contextualize specific examples or arguments. I purposefully omit a discussion of animals here, yet I wholly acknowledge that animals, and specifically pets, are important components of our relationships with the natural world. Additionally, specific therapeutic applications involving nature, such as horticulture therapy, are also omitted. Instead, the present discussion focuses on the potential benefit of natural elements as constituent parts of a given environment or setting.

## 1.2 Love for Nature

To ground my dissertation and serve as the foundational theme I have embraced *biophilia* as the guiding principle by which my work is informed. In the most literal sense, biophilia translates as “love of life,” and it was first described by Fromm (1964). In his book *The Heart of Man*, Fromm contrasted biophilia with *necrophilia* (love of the dead) in his psychophilosophical exploration of man's potential for evil and destruction. However, Fromm's discussion of biophilia was not directed specifically toward nature and the environment, but instead to all life, particularly in the context of human-on-human violence. Thus, while Fromm provides the foundation from which biophilia can be further developed and explored, *his* biophilia has not supported the exploration of human-nature relationships to the extent that a second conceptualization of biophilia has. In

fact, in much of the relevant literature on human-nature-health relationships that refers to biophilia (e.g., Kellert, 1993; Ulrich, 1993; Wilson, 1984; 1993), Fromm's use and conceptualization of biophilia is rarely noted.

The more contemporary and familiar conceptualization of biophilia emerged from E. O. Wilson's (1984) book of the same name, in which he explored the human connection with nature in the face of increasing jeopardization of the natural environment, and biodiversity in general. Wilson defined biophilia as the "innate tendency to focus on life and life like processes" (1984, p.1), and it is this conceptualization—as opposed to Fromm's—which is discussed in most of the contemporary human-environment literature. Wilson used biophilia to inform his discussion of human kinship with nature, and discussed how this affinity could have developed over the course of human evolution. His book, however, does not serve as a systematic discussion about the implication of human-nature relationships to human health or human behaviour in any specific sense. Instead, Wilson's overall discussion of biophilia serves as a vehicle for his argument in favour of a "conservation ethic," which, if realized, would implore humans to protect our kin—the planet's flora and fauna. It is a call to protect life and living systems, and to maximize biodiversity (Wilson, 1984).

On initial consideration, Fromm's biophilia (1964) does not differ significantly from Wilson's (1984) in its overall definition or meaning (i.e., love of life). However, each was developed with a specific purpose and in a unique context, and each was informed by different assumptions. For example, Fromm worked to disentangle his psychophilosophical orientations relative to questions about the essence of good and evil in man (Fromm, 1964). On the other hand, Wilson (1984) contends that biophilia is "innate," thus, implying a genetic predisposition established during human evolution and, therefore, an evolutionary or genetic advantage relating to recognizing safe and prosperous environments. However, while neither elaboration of biophilia incorporated a true theoretical framework from which to scaffold future empirical work, Wilson's biophilia has received further attention, and has since served as an umbrella for the study of human-nature relationships.

The biophilia hypothesis, as it has come to be known, was further investigated and developed from its initial description in an edited volume devoted to the topic (Kellert & Wilson, 1993). Here, Wilson (1993) expanded on his original conceptualization of biophilia and noted that rather than wholly innate and embedded in our genes as a biological artefact, perhaps biophilia was the product of “gene-culture coevolution.” In this way, Wilson (1993) suggests that biophilic preferences and behaviours might have proliferated as a result of the synergistic influence of biological preferences for environments that supported human survival and human aesthetic preferences for particular natural settings manifested in social and cultural phenomena.

In the common vernacular of environmental psychology and human-environment studies, “biophilia” still implies affinity for life and lifelike processes, but it is often used more generally as a theme for empirical investigations of how humans respond to nature and natural stimuli. In fact, Simaika and Samways (2010) point out that the biophilia hypothesis is not currently supported by empirical evidence, yet it remains important because of its broader cultural implications. Therefore, in my current work I have drawn predominately from environmental psychology and the study of restorative environments (REs) to theoretically inform the rationale for my dissertation, while biophilia serves as an overall theme for the work. In the RE literature, there is increasing investigation of the potential for nature and the natural environment to promote positive psychophysiological responses. This emerging evidence is providing new insights into to how we relate to the natural environment, as well as expanding our understanding of how fostering a person’s relationship with nature might promote health and well-being.

### 1.3

In the most basic sense, much of the work investigating REs compares human preference, behaviour, and/or psychophysiological outcomes between settings with varying degrees of natural and built elements (e.g., forest and urban settings). Generally speaking, the RE field is relatively young, with the currently dominating theories emerging over the last 30 years. Two theories have historically grounded the majority of the empirical work in the RE literature: Ulrich’s psychoevolutionary framework (Ulrich, 1983; 1993) and attention restoration theory

(Kaplan & Kaplan, 1989; Kaplan, 1995). Each framework posits its own unique pathways and outcomes, and both theories describe how REs can promote positive health and well-being in humans. Next, each of these two theories will be explored individually and alongside supporting evidence, followed by a broader discussion of how they complement each other and support the present investigation.

### 1.3.1 Psychoevolutionary Framework.

In Ulrich's psychoevolutionary framework (PEF; 1983, 1993), humans are believed to have developed a preference for natural settings that promoted survival over the course of evolution. According to PEF, certain natural settings promote affective and stress-reducing responses in individuals already experiencing stress. According to Ulrich (1983), this framework is based on fast-acting aesthetic responses tied to an innate preference for certain settings and resultant approach-avoidance behaviours. These initial responses are then followed by further in-depth cognitive appraisal which provides complex and abstract information about the setting's content. Fundamental to PEF is visual processing and the notion that aesthetic responses rely on one's ability to quickly interpret a given setting and determine whether one should remain in it. For example, settings depicting obvious animal threats or dangerous terrain should prompt one to seek a different path, while a meadow-like setting might entice lingering and leisure. Ulrich (1983) derives his framework from aesthetics and perception, drawing from work on affect and visual properties, to describe how particular natural settings are likely to elicit preference. Specifically, Ulrich discusses how the elements of a given setting provide information that influences one's aesthetic interpretation of it. In PEF, the characteristics of a scene that evoke an aesthetic response are: complexity, structural properties and focality, depth, ground surface texture, threat, deflected vistas, and water (Ulrich, 1983). Each of these characteristics is discussed briefly below (see Ulrich [1983] for their full development).

- *Complexity.* Ulrich explains that complexity is related to the independence, number, and similarity of elements perceived in a scene. He describes that as the number and dissimilarity of elements increases, so too does the complexity. Ulrich explores the theoretical and empirical literature, describing a consensus among investigators of an

inverted U-shaped relation (i.e., “ $\cap$ ”) indicating that moderate-high levels of complexity are associated with the largest preference responses. Correspondingly, very low or very high levels of complexity are less preferred. In practical terms, a setting that is neither too boring nor too over stimulating is generally preferred aesthetically.

- *Structural properties.* Ulrich continues by describing how perceiving the gross structural properties of a setting, such as order and patterning of elements, is important because they help contextualize one’s perception of complexity. He describes that patterned scenes are preferred over settings in which the elements are random and/or unrelated. Further, he explains how patterning and complexity are related, noting that scenes that are highly complex, yet sufficiently structured (i.e., patterned) can be efficiently processed, thus increasing the potential for evoking preference. Moreover, Ulrich states the importance of “focality” as a primary structural property; it being tied directly to aesthetic responses. For instance, a focal point is particularly important because it provides interest and is able to hold one’s attention while anchoring the rest of the setting and promoting visual exploration.
- *Depth.* In keeping with his position that PEF is tied to an adaptive ability to recognize favourable environments, Ulrich notes that depth cues are important for a viewer to determine whether available space is restricted, possibly containing hidden dangers. An inability to perceive depth leaves the elements of a setting in two dimensions and, therefore, nearly impossible to appraise. Ulrich suggests that settings with clear spatial definition and relationships among elements are preferred relative to those that are either too restricted, or similarly too vast. For example, very dense forests or deserts are more difficult to judge for depth compared to savannahs or more park-like settings containing patterned elements, such as trees.
- *Ground surface texture.* Another important cue, ground surface, is tied to initial depth perceptions. Ulrich describes that ground textures that are relatively smooth should generate preference because they are associated with being conducive to movement and human activity. Likewise, ground cover that is perceived as rough and uneven can

present mobility hazards (i.e., tripping), impede escape, complicate locomotion, and present other possible dangers. As such, relatively homogeneous ground covering that is easily perceived is preferred to uneven or irregular environments.

- *Threat*. Perhaps not surprisingly, one's ability to perceive threat in the environment also is tied to aesthetic preference. Obvious or perceived threats facilitated by the perceptual cues noted above result in avoidance behaviours and, therefore, do not contribute to preference responses. On the other hand, environments free of obvious threats are perceived as more attractive and preferred.
- *Deflected vistas*. Curved or deflected sight lines signal that new information lies beyond what is immediately perceived, prompting one's curiosity. Ulrich notes that curiosity and interest are likely not part of fast-acting affective reactions because they are highly cognitive and require further evaluation and cognitive appraisal. That is, it is more cognitively engaging to wonder about where a path might lead or what lies beyond a hill or stand of trees. Thus, deflected vistas promote curiosity and mystery in an observer, thereby drawing one further into the setting and requiring further engagement, in turn promoting reflection and exploration.
- *Water*. Ulrich notes that water is commonly described in the literature as evoking interest, preference, and positive affect. He adds that the presence of non-threatening water can be expected to magnify liking and approach responses, further promoting engagement in already preferred environments.

In summary, Ulrich (1983) suggests that natural settings that are easily interpreted, relatively expansive with a focal point or deflected vista, and that are perceived to be unthreatening are more likely to be preferred compared to settings that lack some or all of these qualities (Ulrich, 1983). Simply put: natural spaces that are safe, easily interpreted, and foster human activity are proposed to promote psychophysiologic recovery from stress and improved affect. Further, it is predicted that preferences for such restorative settings may have been inherited through evolution because they fostered human survival. For example, an already stressed individual who

is able to identify and spend time in a relatively safe setting with accessible resources should experience recovery from stress and improved positive affect, which in turn would promote efficiency and survival. In a more contemporary context, one who encounters a *natural restorative environment* (NRE) is expected to experience improved emotional states mediated by positive changes in affect (i.e., improved positive emotions and decreased negative emotions), as well as reduced stress resulting from arousal of the autonomic nervous system (e.g., reductions in heart rate and blood pressure, and relaxed muscle tone; Ulrich, 1983, 1993). Indeed, as will be described below, empirical investigations exploring such psychophysiological responses to NREs have shown support for the assumptions and predictions outlined by PEF.

### 1.3.1.1 Current Evidence in Support of the Psychoevolutionary Framework

In one early study in which previously stressed students were shown either scenes of natural spaces or built spaces, Ulrich (1979) reported that individuals in the nature group experienced higher levels of positive affect and decreased fear arousal after the viewing task when compared to individuals in the built group. In another study, Ulrich, Simons, Losito, Fiorito, Miles, and Zelson (1991) used a workplace safety video to stress participants before they were shown a video depicting one of six environmental conditions ranging from natural vegetation to an urban scene with heavy traffic. In this study Ulrich and colleagues (1991) reported that results from physiologic (e.g., cardiac and skin conductance) and affective measures indicated improved recovery from stress in individuals in the natural video groups compared to those who viewed videos of more built environments. Similarly, in a study in which male participants spent time in either a city setting or a forest setting, Park, Tsunetsugu, Kasetani, Hirano, Kagawa, Sato et al. (2007) described that time spent in the forest setting was found to be calming and more comfortable as reported by participants. As well, Park et al. (2007) found that participants who spent time in the forest setting were calmer and less stressed than those in the city setting, citing lower physiological measures of both cerebral activity and salivary cortisol, respectively.

Overall, considering that PEF predicts positive psychophysiological benefits based on environmental interactions, the potential exists for important implications to human health and well-being—particularly so for individuals already experiencing stress secondary to ill-health.



For instance, because Ulrich (1983) posits positive responses in already stressed individuals, it may be possible for individuals experiencing stress and negative emotions secondary to illness and treatment to benefit from experiencing NREs. Further, it could be possible to foster such connections in hospitals and health care settings through interior design elements, window views afforded from procedure and recovery rooms, and on-site green spaces. Evidence that corroborates such applications will be presented following a discussion of the other major theory in the RE literature: attention restoration theory.

### 1.3.2 Attention Restoration Theory

Attention restoration theory (ART) was advanced by Rachel and Stephen Kaplan (Kaplan & Kaplan, 1989; Kaplan, 1995) and focuses on psychological processes associated with perception and attention. Whereas PEF assumed that restorative pathways were the products of survival and evolution, ART predicts restoration along cognitive pathways associated with attention. Kaplan and Kaplan (1989) develop ART from the work of William James (1892), who discussed his belief that humans are able to purposefully direct attention using *voluntary attention*. In this circumstance, one's attention is directed toward something in a voluntary manner, meaning that one must actively inhibit competing or distracting stimuli. On the other hand, James (1892) discussed that when something is interesting in-and-of itself, one is able to attend to it effortlessly via *involuntary attention*. Extrapolating from James's description of voluntary attention, Kaplan and Kaplan (1989) use the term *directed attention* to refer to attentional processes requiring intent and effort to sustain focus and ignore competing distractions. Consequently, because directed attention is effort-dependent, it is susceptible to processes of fatigue. And, because directed attention is fundamental to human effectiveness, directed attention fatigue is potentially dangerous when one is responsible for making important decisions with a high impact on the public, such as nuclear technicians, pilots, and public safety personnel (Kaplan & Kaplan, 1989; Kaplan, 1995). Stephen Kaplan (1995) explains further that such directed attention fatigue is familiar to anyone whom has worked on a demanding project, students and faculty being the obvious examples here.

In contrast to directed attention, Kaplan and Kaplan (1989) use the term *fascination* to refer to James's (1892) concept of involuntary attention; that is, attention that is sustained without effort. Differentiating between directed attention and fascination hinges on the premise that some phenomena are inherently interesting and, thus, capture one's attention without requiring that individual to actively focus and ignore competing distractions. Fascination is further described as existing along a continuum which distinguishes *hard* fascination from *soft* fascination. Whereas hard fascination is generally likened to arousal and excitement, such as that generated by sporting events, soft fascination—characteristic of nature—is differentiated by permitting the opportunity for reflection (Kaplan & Kaplan, 1989; Kaplan, 1995). Thus, because fascination is effortless, it is predicted that soft fascination in particular provides the appropriate opportunity for reflection and for one's directed attention processes to rest and replenish (i.e., directed attention restoration). For the purpose of my dissertation, I will use "fascination" to refer to soft fascination for the remainder of this work. It is likely that the concepts of directed attention fatigue, directed attention restoration, and restorative environments are intuitively familiar to most readers. For example, the simple respite provided by mini breaks looking out one's window, or having lunch under a tree or in a garden often leaves us refreshed and mentally restored.

In ART, it is predicted that fascination is engaged through stimuli that are sufficiently interesting to the observer. The term "restorative environments" (REs) is used in ART to define the types of settings that can promote directed attention restoration (Kaplan & Kaplan, 1989). However, REs are not distinguished solely by being fascinating. Indeed, fascination is only one of four components of an RE according to ART. The other three components of REs defined by ART are: *being away*, *extent*, and *compatibility* (Kaplan & Kaplan, 1989), and each is elaborated further below.

- *Being away.* In ART, being away represents a sense of mental respite or a state of "getting away." Being away does not refer to being in some distant location, but instead Kaplan (1995) described being away as a conceptual shift in one's attention that frees an individual from immediate matters at hand. For example, brief moments spent daydreaming while looking out a window provide opportunities for getting away.

- *Extent.* Kaplan and Kaplan (1989) describe that extent refers to the potential that the content of a given setting can engage the mind—that there is enough to look at, think about, and experience. Kaplan (1995) notes that for an environment to have adequate extent and be restorative, the constituent elements must be rich and coherent, essentially creating the sense of “another world.” As such, a setting of adequate extent can occupy a significant proportion of one’s cognitive capacity to engage fascination. Kaplan and Kaplan (1989) describe that extent and fascination are mutually supportive components (p. 185).
- *Compatibility.* Finally, compatibility refers to the level of agreement between the environment and one’s intentions (Kaplan & Kaplan, 1989). Stated differently, a compatible environment is one that permits an individual to accomplish what it is s/he is trying to do in that setting, be it a picnic or nap under a tree, or a leisurely stroll. Essentially, compatibility refers to a setting being conducive to human activity, and thus not threatening or dangerous.

ART predicts that the potential for directed attention restoration exists when fascination, being away, extent, and compatibility exist in combination within a given environment. Therefore, one who spends time experiencing an RE is expected to experience directed attention restoration and, thus, will be better able to direct and focus attention after that experience. Kaplan and Kaplan (1989) discuss that while there are a number of potential environments that may be considered restorative (e.g., library, café, a favourite room, etc.), natural spaces often make very good REs, especially compared to most built environments. As described below, empirical evidence from the RE literature has supported the ART framework.

### 1.3.2.1 Current Evidence in Support of Attention Restoration Theory

In one example, Berto (2005) explored the restorative potential of NREs relative to directed attention performance. In this study students were mentally fatigued using attention tasks before viewing scenes containing either natural or urban content. She reported that individuals in the nature group outperformed individuals in the urban group on a sustained attention task

designed to measure directed attention. In a different study, Tennessen and Cimprich (1995) investigated the capacity of university students to direct attention based on the content of window views from their dormitory room. Using objective and subjective measures of directed attention, Tennessen and Cimprich (1995) reported that those with dormitory window views that offered more natural scenes performed better compared to students whose views were dominated by built content. Together, these two studies support the ART framework in adult populations, while similar results have also been reported in in paediatric populations.

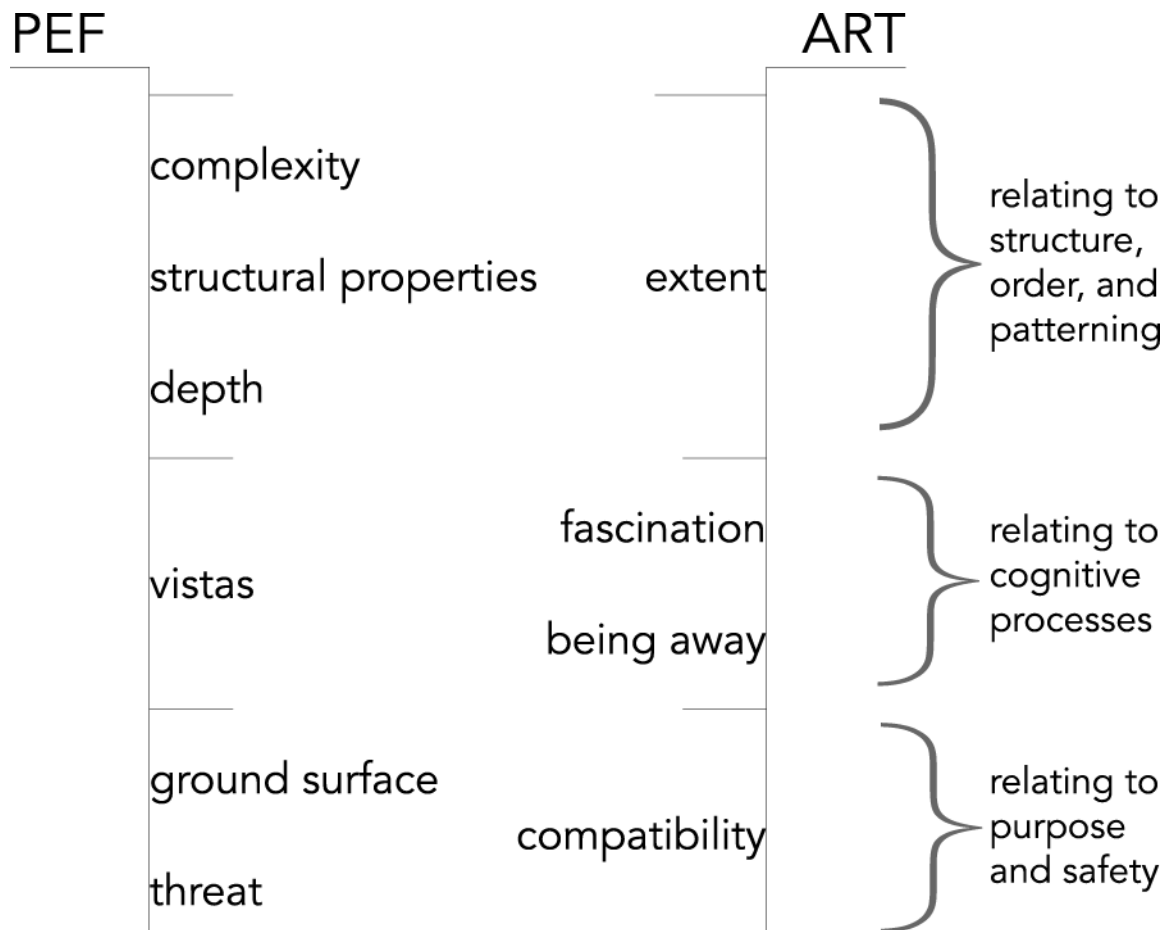
For example, in two studies, Faber Taylor, Kuo, and Sullivan (2001) and Faber Taylor and Kuo (2009) assessed the effects of natural REs on the symptoms of attention deficit disorders in children. In the first study, children diagnosed with either attention deficit disorder (ADD) or attention deficit hyperactivity disorder (ADHD) were included. Faber Taylor et al. (2001) investigated parents' ratings of their child's symptoms after playing in green, outdoor built, or indoor play settings. Parents in this study described their children as experiencing less severe symptoms and being more manageable after playing in green settings compared to built or indoor settings. In a follow-up study, Faber Taylor and Kuo (2009) had children diagnosed with ADHD complete attention measures before and after taking walks in urban park, residential, and downtown environments on separate occasions. In this second study, Faber Taylor and Kuo (2009) reported that the children performed significantly better on the attention measures following the park walks compared to their scores in either of the residential or downtown walks. Interestingly, Faber Taylor and Kuo (2009) estimated the effect sizes of these differences to be nearly as large as the attentional deficit attributed to ADHD, as well as the reported effect sizes of current pharmaceutical treatments. Collectively, these studies summarize an increasing body of evidence supporting the predictions of ART. As described by Kaplan (1995), the importance of directed attention in human effectiveness makes clear how simple ways to promote directed attention restoration could have important impacts. However, not only is this potential important for human effectiveness and productivity, but also for potentially contributing to directed restoration in individuals experiencing negative cognitive side effects resulting from disease and treatment.

Overall, both PEF and ART advance frameworks that predict benefits in individuals who experience NREs. According to PEF (Ulrich, 1983), these restorative benefits occur along psychophysiological pathways, while ART (Kaplan & Kaplan, 1989) predicts restorative benefits along cognitive pathways. However, if the predicted necessary conditions and expected outcomes for PEF and ART are considered more broadly, similarities between what settings predict restoration and what restoration includes might lead one to question to what extent these two theoretical frameworks might overlap?

### 1.3.3 Complementary Nature of PEF and ART

Respectively, each of PEF and ART describe environmental conditions predicted to promote restorative human responses. While each of these two theories emerged separately and are supported by empirical evidence, it is not difficult to note similarities in both the definition of restorative stimuli, as well as the predicted outcomes. For example, Figure 1 compares the relative overlap of the theoretical conditions and outcomes described by PEF and ART. This figure shows that while PEF and ART each describe unique characteristics of REs, it could be the case that the types of environments they are describing are one in the same. Furthermore, it is possible that not only may PEF and ART overlap, but that they might be complementary frameworks (Hartig, Evans, Jamner, Davis, & Gärling, 2003). That is, instead of offering discrete theoretical frameworks, PEF and ART might rather describe constituent parts of a larger human-environment response.

Hartig and colleagues (2003) have discussed that rather than existing in opposition and acting as separate systems, PEF and ART may exist and serve as complementary frameworks. Specifically, these authors have described that the “type” of restoration one experiences could depend on one's pre-existing depleted psychophysiological states, or what they refer to as the *antecedent condition* (Hartig et al., 2003, p. 110). In this sense, the antecedent condition describes one's state of being *before* experiencing a NRE, such as being stressed, experiencing negative emotions, or suffering directed attention fatigue. Hartig et al. note that one can experience stress, negative affect, or directed attention fatigue alone, in different temporal sequences, or in varying combinations.



*Figure 1.* Theoretical overlap of the psychoevolutionary framework and attention restoration theory. The theoretical components of the psychoevolutionary framework (PEF) and attention restoration theory (ART) are sorted according to the general overlap of their broader theoretical implications. This figure serves as a demonstration, and is not supported empirically at the time of publication.

In their study, Hartig et al. (2003) asked students to drive to one of two locations (as a stressor) and led participants on walks in either a natural or urban field setting while having their physiological, mood, and attention measurements recorded. Before these walks, individuals were randomized into one of four groups: a nature walk with or without pre-walk attention tasks, and an urban walk with or without pre-walk attention tasks. These authors discussed findings that provided general support for the restorative potential of NREs, reporting that blood pressure dropped in individuals with window views of nature compared to those with built window views during a seated pre-walk phase. This trend in blood pressure response was found to continue to the mid-point of the walks where lower blood pressure measurements were recorded in individuals on the nature walk compared to those on the urban walk. Further, participants in the nature walk group were found to report improved affect and better performance on a measure of directed attention when compared to their counterparts who completed the urban walk. Specifically, those individuals in the no task nature group reported higher overall happiness scores during their walk. Similarly, performance on the measure of directed attention was also found to improve for individuals in the nature group and decrease in individuals in the urban group, regardless of whether or not they completed the pre-walk attention-draining task. Collectively, these findings suggest fostering human connections with a NRE might promote psychophysiological and directed attention restoration as predicted by PEF and ART, respectively.

The theoretical and practical implications of Hartig et al.'s (2003) study are important because they acknowledged a potential overlap between the PEF and ART frameworks. However, Hartig et al. do not further develop the theoretical tenets of PEF, ART, or a hybrid of the two, nor has there been much theoretical development in the literature since. Instead, investigators in the RE field tend to adopt one of the two theories to inform their work, or have advanced their work under the umbrella of “restoration” and/or “restorative environments”—drawing components from each of the two frameworks. In this latter regard, outcomes of interest span manifestations of stress, affect, and attention, as well as including broader outcomes measures related to health and well-being. Overall, however, given that little difference may be observed between what constitutes a NRE as described by either PEF or ART, it is likely that an environment that

satisfies the criteria for an NRE according to one, also does so for the other. Therefore, such an NRE might promote broader psychophysiologic and directed attention restoration than predicted solely by either PEF or ART.

However, if PEF and ART describe complementary responses, then there are important theoretical and practical implications to consider. For example, it might be important to consider whether each framework is not unique yet complementary, but instead constituent parts of a broader, more global response. If so, it would then be important to describe what such a global response might be, as well whether there exist potential outcomes in addition to psychophysiologic and attention restoration.<sup>1</sup> Indeed, Parsons, Tassinary, Ulrich, Hebl, and Grossman-Alexander (1998) have discussed how increasingly complex NRE-based restorative outcomes may be compared to the originally predicted outcomes relating to affect, stress, and attention. Moreover, while Hartig et al. (2003) first discussed the potential complementary nature of the PEF and ART frameworks, Hartig, van den Berg, Hagerhall, Tomalak, Bauer, Hansmann et al. (2011) have described how NREs might promote broader health and well-being outcomes. Further, Hartig and colleagues (2011) have noted that there has been little advancement of a more integrated framework accounting for more global (i.e., generalized) health outcomes. As such, in the absence of a single framework, RE-related empirical work continues forward under the “restoration” umbrella, thus building a broader and more comprehensive understanding of healthy human-nature relationships. In the current state of the RE field, this approach is yielding new and important evidence related to health and well-being outcomes associated with NREs.

## 1.4 Human-Nature Relationships, Health, and Well-Being

Human-nature-health relationships have been investigated in varying contexts, including controlled laboratory experiments, health care contexts, schools, and penitentiaries, to name a few. In the most basic sense, the common theme driving such investigations pertains to

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<sup>1</sup> From this point forward, *psychophysiologic* restoration, or simply *restoration*, will be assumed to include directed attention restoration, unless otherwise specified.



questions of whether NREs might contribute to positive psychophysiological responses. However, there is also emerging evidence supporting broader restorative responses relative to improved general health and well-being. Below, some of this evidence from healthcare contexts will be presented, followed by further evidence relating to broader public health related implications of NREs.

#### 1.4.1 Natural Restorative Environments in Healthcare Settings

In one unpublished exploration on the use of natural REs in healthcare settings, Heerwagen (1990) discussed an example in which a mural depicting an idyllic natural landscape was displayed in a dental fears clinic (unpublished data as cited in Heerwagen, 1990). Heerwagen explained that the study compared days during which the mural was hung to days when the wall was left blank. Heerwagen (1990) noted that patients of the clinic reported being more calm and less tense on days when the mural was hung, as measured by an affective questionnaire. In another unpublished work, Coss (as cited by Ulrich, 1993) compared physiologic measures from patients who were lying on hospital gurneys waiting for surgery. Ulrich (1993) described that ceiling tiles above the patients' heads displayed either a serene natural scene depicting water, an active water scene showing a sailboarder, or no image at all. On average, individuals in the serene nature group were found to have systolic blood pressures that were 10-15 mmHg lower than individuals in the other two groups.

Continuing, empirical investigations focussing on the role of nature and natural elements in health care environments also echo the potential benefits of human experiences with NREs. For instance, in a frequently cited study, Ulrich (1984) compared the hospital charts of individuals who had undergone gall bladder surgery and spent time recovering in one of two post-operative recovery rooms: one room with a window view that was entirely composed of an adjacent brick wall, and the second that looked out upon a small group of trees. After examining the records of 23 individuals from the nature group and 23 matched controls from the wall group, Ulrich reported that those with the natural window view were found to have shorter post-operative hospital stays and required less strong analgesics. Moreover, Ulrich (1984) found that charts belonging to those from the brick wall group contained a greater number of negatively toned

comments made by nurses relative to those who comprised the nature group. In a different hospital-based study, Diette, Lechtzin, Haponik, Devrotes, and Rubin (2003) tested the effects of a privacy curtain displaying a natural image compared to a blank curtain on the pain experiences of individuals receiving a bronchoscopy. In this study, Diette et al. (2003) reported that those in the nature group reported better pain control, particularly among older individuals and those with a better health status when compared to the control group.

In a similar vein, Moore (1981) investigated the effect of a prison environment, and specifically cell-window views, on the health of inmates. In this study, Moore found that those individuals whose prison cell looked out upon a natural scene reported to the infirmary less often and, by implication, required less healthcare services, compared to individuals whose cell views were of either the prison's interior or the outdoor prison yard. Thus, this evidence might suggest that architectural and design elements such as window views and interior design (e.g., decorations) that afford opportunities to view a NRE might promote restoration and broader positive health outcomes.

Continuing, Cimprich and Ronis (2003) described a study in which they asked a group of women who were receiving treatment for breast cancer to spend time experiencing (e.g., watching, sitting in) natural REs. In this study, women were randomized into either a control group or a nature group; those in the nature group were asked to spend 120 minutes per week experiencing natural REs. The intervention was designed to begin before surgery and end after its completion, but prior to initiation of any adjuvant therapy. Cimprich and Ronis (2003) reported that women in the nature were better able to direct their attention based on a series of attentional measures compared to women who received standard treatment. These results are similar to previous work conducted by Cimprich (1993) where she reported results of a study in which women who participated in nature-related restorative activities after receiving surgery for breast cancer performed better on attentional measures across a timeline ending at 90 days postsurgery. Cimprich (1993) noted the importance of interventions that can promote the retention and restoration of directed attention during cancer care, describing that individuals treated for cancer can face significant reductions in attentional capacity. Therefore, efficient and efficacious interventions that could mitigate directed attention fatigue might be important for

maintaining health and well-being, particularly when cognitive and attentional capacities are affected by disease and treatment.

Overall, this set of examples highlights how integrating natural elements and natural REs more broadly into healthcare environments might contribute in small, yet important ways to promoting well-being in individuals experiencing ill-health. This is particularly evidenced by examples such as Ulrich (1984) and Diette et al. (2003) where the findings exist within a broader scope relating to general health, compared to specific psychophysiologic outcomes predicted by PEF and ART. Such findings are important given the interconnectedness of health and well-being, and because similar benefits could be experienced by outpatients and for those participating in long-term therapy and rehabilitation regimes.

#### 1.4.2 Natural Restorative Environments and Public Health

In addition to more traditional healthcare settings, there is an emerging evidence base that highlights potential relationships between NREs and health at the broader community and population levels. For example, a series of studies from the Netherlands has explored population-based health data in relation to the presence of green space in the environment across that country. First, de Vries, Verheij, Groenewegen, and Spreeuwenberg (2003) have explored the role of “greenness” around one’s living environment and its potential effect on self-reported health. They found that greenness in the environment around one’s home had a stronger relationship with perceived health than urbanity. deVries et al. (2003) specifically noted fewer self-reported symptoms over the last two weeks and better general health on a national health survey for individuals with a higher degree of greenness around their homes. Further, the authors noted the importance of a garden relative to the frequency self-reported symptoms in particular (de Vries et al., 2003).

In another study, Maas, Verheij, Groenewegen, de Vries, and Spreeuwenberg (2006) investigated data from the practice populations of a set of Dutch general practitioners relative to environmental characteristics from a national land classification database. In this study, the authors reported that there was a significant relationship between green space within a 1 and 3 km radius of one’s home and better self-reported general health. Specifically, this relationship

was found to be strongest for those with a lower socioeconomic status (SES), as well as for youth and the elderly (Maas et al., 2006). A follow-up study by Maas, van Dillen, Verheij, and Groenewegen (2009) explored these relationships further by using disease prevalence data obtained from physician medical records. In this study the authors investigated 24 different disease clusters and found that there was a lower annual prevalence for 15 of these clusters associated with living environments where there was a higher concentration of green space within 1 km of the home. As before, Maas et al. (2009) reported that the relationship was particularly strong for those with a lower SES and for children. This relationship between proximity to green space and improved health in younger, older, and lower SES populations in these two studies (Maas et al., 2006, 2009) is particularly important because these groups represent individuals who may have decreased access to healthy resources and social determinants of health (e.g., income, education, healthy food alternatives, etc.).

Additionally, Mitchell and Popham also have reported interactions between green space, SES, and health in two UK studies (Mitchell & Popham, 2007; Mitchell & Popham, 2008). In the first, Mitchell and Popham (2007) looked at population-level health data and geographical land classifications, reporting similar findings to those reported by the Dutch studies discussed above. In particular, Mitchell and Popham (2007) described a significant relationship between higher proportions of green space and better self-reported health; however, there was a notable exception relating higher degrees of green space in low-income suburban areas with worse health. To try and explain this interaction, the authors hypothesized that high proportions of green space in lower SES areas could potentially be of “low quality” and, therefore, potentially not afford the same health benefits and opportunities for restoration as higher quality green space (e.g., healthier, more accessible, and/or more aesthetically pleasing, etc.). In their follow-up study, Mitchell and Popham (2008) stratified similar data across SES levels and proportions of green space. The authors again found a positive association between health and higher proportions of green space. Interestingly, however, in this study Mitchell and Popham (2008) were exploring health inequality as measured by mortality data, and reported that lower levels of income-related health inequality were found in populations with higher proportions of green space compared to populations with lower proportions of green space. Together, these two

studies, as well as those by the Dutch groups have significant implications for public health and health promotion—specifically, that better access to higher proportions of green space could be important for the general population. Moreover, this relationship might be particularly important for individuals who might otherwise be disadvantaged relative to access to traditional social determinants for health.

Finally, van den Berg, Maas, Verheij, and Groenewegen (2010) investigated the potential “buffering effects” of green space on health using the same Dutch environmental data. Their health data were gathered from a sub-population of citizens who answered in-depth health surveys as part of a national census. van den Berg et al. (2010) reported that there might be a buffering effect of green space existing within a 3 km radius of one’s home. Specifically, van den Berg et al. reported lower rates of stressful life events as measured by self-reported health complaints, mental health, and general health status for individuals with green space within 3 km of their home. Additionally, similar potential buffering effects also have been reported by Wells and Evans (2003). Wells and Evans (2003) explored the potential effects of nearby nature on children’s experiences of life stress. In their study Wells and Evans (2003) found that higher degrees of nearby nature buffered the impact of life stress on children as measured by both parent-reported measures of distress, as well as self-reported measures of perceived self worth.

In aggregate, the evidence surveyed in each of the previous sections converge to offer compelling evidence highlighting the potential benefits to health and well-being experienced by individuals whose environments have an increased proportion of green space. To put it bluntly, the evidence would suggest that fostering exposure to and engagement with NREs can be expected to promote restoration along psychophysiologic and attention pathways, as well as broader restorative outcomes manifest as benefits to general health and well-being. As described above, these restorative responses to NREs have been found in a number of populations, including healthy individuals, children, elderly, those in lower SES brackets, and individuals experiencing ill-health and disability. Moreover, studies conducted at the population level are particularly interesting for two reasons: First, they indicate the potential for benefits to health and well-being across a wide community scale. Second, these population-based studies do not assume that one must first experience a health or well-being deficit (i.e., an antecedent condition) in order to

experience restorative benefits of NREs. Thus, the potential that NREs might promote health and well-being becomes increasingly notable given the broader implications to promoting restoration, namely that NREs and natural elements in our everyday environments might contribute to improved public health and health promotion, as well as more specified psychophysiologic and attention restoration. Moving forward, the next section will describe the psychological and philosophical perspectives that inform the methodology used in my dissertation.

## 1.5 Adopting a Psychological Perspective of Enquiry

The theoretical work in the RE literature that has advanced the PEF and ART perspectives forms an important cornerstone of this dissertation. However, deciding *how* to frame my investigation and through what *lens* I would ask my questions and interpret the data required adopting a theoretical framework that would support and inform my enquiry. To this end, personal construct psychology (PCP; Kelly, 1955) was identified as a theoretical perspective that was congruent with an investigation of individual perceptions of NREs. Below, PCP as a theory of psychology is described and its assumptions and predictions explored, as well as and how it fits in the present context. As a reading aid, Appendix A provides a glossary of relevant PCP terms, as well as other acronyms used in this dissertation.

### 1.5.1 Personal Construct Psychology

Personal construct psychology was advanced by George Kelly in a two volume tome in 1955 that advanced not only the theory of PCP, but also the fundamental technique for investigating personal constructs. As described by Kelly (1955), PCP is a theory of personality built upon a *fundamental postulate*, and elaborated further by 11 *corollaries*; the central premise being that every individual uses a series of bi-polar constructs to interpret phenomena and predict future events. Kelly's theory is noteworthy not only because it offers a full theoretical framework and investigative technique (i.e., the repertory grid), but also because it is built upon a strong philosophical foundation. First, PCP will be expanded before exploring the philosophic premise that it is built upon, followed by an elaboration of the fundamental postulate and the corollaries.

The theoretical perspective of PCP will then be contextualized within the present context of oncology rehabilitation and promoting healthy human-nature relationships.

### 1.5.1.1 A Primer on Personal Construct Psychology

Personal construct psychology might be summarized best by the analogy that Kelly (1955) offers, framing the individual as a *scientist*. His “man the scientist” abstraction suggests that one uses *constructs*—patterns of existing experiences differentiated by bi-polar comparisons—to interpret phenomena, make sense of outcomes based on those interpretations, and to predict similar future events. For example, constructs such as *hot–cold*, *up–down*, or *hard–soft* provide simple examples of how interpretations of phenomena can be differentiated. Indeed, interpretations of complex phenomena, such as social encounters require more elaborate constructs (e.g., *moral–immoral*) organized as a framework that permits one to employ multiple constructs in order to adequately perceive and interpret the situation. In most cases, constructs are temporary and dynamic; they are modified as necessary as every experience either validates our predictions, thus reinforcing our construct framework, or invalidates our predictions, prompting a redefinition of constructs. In the present case, PCP serves as the theoretical lens through which I have framed my understanding of the individual and how I have conceptualized my investigation related to perceptions of NREs.

### 1.5.1.2 Philosophical Orientation: Constructive Alternativism

In Kelly’s (1955) elaboration of PCP he began by stating a philosophical perspective from which he outlined his position on how one interacts with the universe. His resulting perspective, *constructive alternativism*, describes reality as something real and in motion, and that the individual comes to understand the universe through experience and the iterative creation and redefinition of constructs. In their introduction to PCP, Hardison and Neimeyer (2012) state that PCP assumes “that humans literally construct the meanings of their own lives” (p.3), and that constructive alternativism permits infinite constructions of reality, or at least as many as one can invent. However, it is important to note that Kelly firmly declared a belief in the existence of a single and true universe and a “real world” with which the individual interacts (1955, p. 6). In his introduction to constructive alternativism and his discussion of the universe in which we live,

Kelly outlined three convictions: that it is real; that every element in the universe fits together with an exact relationship (i.e., it is integral); and that it is in motion, measureable against time (1955, pp. 6-7). Therefore, according to PCP there is one real world, but this real world is constantly changing. Construct frameworks, however, are based on prior experience and, like the universe, the individual also is in motion through time. Thus, with every successive event one encounters, constructs are reaffirmed or redefined and realigned to appropriately square one's construction of reality with the (new) real world.

The tenets of PCP and constructive alternativism have been the subject of investigation and debate since Kelly first introduced them in 1955. For example, Walker and Winter (2007) provide a succinct summary of PCP and its evolution, noting Kelly's debts owed to Dewey and Mead, as well as its relation to more contemporary interpretations of "constructivism." Additionally, Viney and Nagy (2012) describe the ontological and epistemological fit between PCP and interpretive paradigms of enquiry characteristic of qualitative methodologies. For some, Kelly's (1955) acknowledgement of a "true" universe and real world that can be construed, interpreted, and understood in infinite ways may be unsettling and incompatible. However, it is a position that is congruent with my own philosophical interpretations and my understanding of how we relate to each other and the universe. What's more, an acknowledged real world that is construed independently is also compatible with Wilson's expansion of the biophilia hypothesis (Wilson, 1993). For instance, recall that Wilson further elaborated biophilia relative to the co-dependent and iterative roles of biology, evolution, culture, and experience (i.e., gene-culture coevolution) in the establishment of patterned preferences for NRE-type environments (Wilson, 1993). Overall, this treatise draws predominately from Kelly's writings on constructive alternativism and is contextualized relative to the 11 corollaries that theoretically elaborate PCP.

### 1.5.1.3 Corollaries in Personal Construct Psychology.

The fundamental postulate on which PCP is predicated offers a single conceptualization of the individual in the world. This conceptualization is elaborated by 11 corollaries that serve to contextualize and operationalize it. Plainly, the fundamental postulate states: "a person's



processes are psychologically channelized by the ways in which he anticipates events” (Kelly, 1955, p.46). According to Kelly, its components can be broken down as follows: “processes” implies motion; “psychologically” orients PCP in the realm of psychology, meaning the business of conceptualization rather than, but not necessarily completely independent of physiology or sociology; “channelized” serves to organize one’s psychological processes in a network; “ways” refers to the constructs one invents; “he” indicates choice, meaning one is free to choose to operate differently from another; “anticipates” links the individual to the scientist, implying a desire for prediction; and finally, “events” are the real-world stuff of life and the universe (Kelly, 1955). In other words, the fundamental postulate states that one perceives and interprets phenomena based on past experiences, and that the outcomes of an experience will inform one’s predictions of similar encounters in the future. In PCP, events and phenomena are *construed* according to the definition of one’s constructs with a given *range of convenience* (i.e., scope) to which those constructs apply. It is this description of the individual in the world and how one construes events and phenomena upon which all of PCP is elaborated.

While the fundamental postulate serves to establish PCP as its own theory and way of doing psychology, the 11 corollaries are the apparatuses that make Kelly’s work a whole system. In order to succinctly assemble PCP in its entirety, the corollaries are described in Kelly’s (1955) own words below:

- *Construction Corollary*: A person anticipates events by construing their replications.
- *Individuality Corollary*: Persons differ from each other in their constructions of events.
- *Organization Corollary*: Each person characteristically evolves, for his convenience in anticipating events, a construction system embracing ordinal relationships between constructs.
- *Dichotomy Corollary*: A person’s construction system is composed of a finite number of dichotomous constructs.

- *Choice Corollary*: A person chooses for himself that alternative in a dichotomized construct through which he anticipates the greater possibility for extension and definition of his system.
- *Range Corollary*: A construct is convenient for the anticipation of a finite range of events only.
- *Experience Corollary*: A person's construction system varies as he successively construes the replications of events.
- *Modulation Corollary*: The variation in a person's construct system is limited by the permeability of the constructs within whose ranges of convenience the variants lie.
- *Fragmentation Corollary*: A person may successively employ a variety of construction subsystems which are inferentially incompatible with each other.
- *Commonality Corollary*: To the extent that one person employs a construction of experience which is similar to that employed by another, his psychological processes are similar to those of the other person.
- *Sociality Corollary*: To the extent that one person construes the construction processes of another, he may play a role in a social process involving the other person.

(pp.103-104, reprinted with permission)

In its most distilled form, PCP predicts that one makes sense of phenomena by construing them against existing bi-polar constructs based on one's past experiences (construction, dichotomy corollaries). Experience shapes the definition and orientation of these constructs in one's construct framework (organization, experience corollaries), which s/he uses to predict the outcome of future events within a similar range of convenience (range, modulation, fragmentation corollaries). Construct frameworks are unique to every individual (individuality, choice corollaries), but through the shared construing patterns of social phenomena we come to build and share common expectations and patterns of behaviour, such as culture and language

(community, sociality corollaries). Indeed, reducing PCP in such a basic sense threatens to strip it of its comprehensiveness and scope; however, the elaboration provided here captures PCP's foundations, purpose, and utility sufficiently for my purposes. What's more, while the 11 corollaries are important to PCP in its totality, they are not all fundamental in the present context, particularly because Kelly's (1955) introduction of PCP is relatively protracted, as well as focussing primarily on counselling psychology and psychotherapy. Consequently, in subsequent sections, a focus only on those corollaries and nuances of PCP that are salient to this investigation is included.

Finally, there have been previous examples of the use of PCP and the repertory grid technique in the human-environment literature. First, Harrison and Sarre (1971) have advocated a personal construct approach to investigating environmental perception, noting how well suited PCP is to uncovering the meanings an individual attributes to objects and places. These authors later described two English studies based on PCP: the first in which female residents made judgements about their surrounding urban environment; and the second where shopkeepers were interviewed to investigate their surrounding business environment (Harrison & Sarre, 1975). Later, Scherl (1980) employed a personal construct methodology to investigate how participants perceived wilderness experience programs in Australia and, further, Chipeniuk (1999) has relied on PCP to investigate potential cultural differences in interpretations of landscape naturalness. Last, and in the closest application to REs specifically, Home, Bauer, and Hunziker (2010) relied on PCP to investigate if preferences for green space in residents from Zurich were determined biologically, culturally, or in some mixture of the two. In each of the cases above, the repertory grid technique was used to collect and analyze data.

Overall, the general consensus from these studies advocates integrating the PCP framework and repertory grid technique into investigating human perceptions of nature and the environment because of the ability to elicit personal meanings from the data. Thus, while the work described herein might be the first use of PCP relative to PEF and ART, it has been preceded by notable contributions to the human-environment literature. Next, information related to the disability-related impacts of oncology treatment and rehabilitation will be introduced. Consequently, an

effort to build a rationale for the present investigation as it is informed by the biophilia hypothesis, in general, and PEF, ART, and PCP in specific will be provided.

## 1.6 Treatment-Related Disability in Oncology

Cancer and its treatment are associated with significant impact on one's well-being and quality of life (de Haes & Knippenberg, 1985; Chang, Hwang, & Feuerman, 2000). In the short term, individuals diagnosed with cancer experience symptoms related to the manifestation of the actual disease, in addition to treatment-related sequelae, and psychosocial distress (Holland, Watson, & Dunn, 2011). Over the long term, one is faced with changes in anatomy and function resulting from the cancer itself, as well as lasting side-effects secondary to one or multiple modalities of treatment, and the potential to continue experiencing psychosocial distress and fear of recurrence (Carlson, Waller, Groff, Giese-Davis, & Bultz, 2011). Indeed, the effects of cancer and its treatment are far reaching, impacting the physical, psychological, and social spheres of one's life, as well as the lives of caregivers, family, and friends. In a *very* general sense, the trajectory of a cancer diagnosis is relatively predictable, as the treatment for any given malignancy will often exist within a known scope of possible surgical, chemotherapeutic, and/or radiation therapy interventions. However, neoplastic characteristics of the tumour (e.g., site, size, growth rate, regional or distal spread, etc.) and one's personal characteristics result in highly individualized experiences of the diagnosis and treatment trajectory. Among various cancer sites, stages, and treatment options, treatment outcomes and experiences can vary widely.

The primary goal of chemotherapy as a treatment regime for cancer is to inhibit the proliferation of neoplastic cells (Skeel, 2011). This is accomplished because chemotherapeutic agents are designed to be toxic to cells. However, while chemotherapy is used to kill cancer cells, otherwise normal and healthy cells are killed as well. Chemotherapeutic agents target cells that multiply rapidly, characteristic of neoplastic cells, but in doing so also target healthy cells that are designed to multiply rapidly, such as those found in bone marrow and mucosal linings.

Generally speaking, there are a number of characteristic side effects that accompany chemotherapy. For example, chemotherapy protocols are often associated with a predictable set of common acute toxicities such as changes in blood characteristics (e.g., anemia), drug leakage

into subcutaneous tissue, nausea and vomiting, diarrhea, oral sores, skin irritations, hypersensitivity, neurotoxicity, hair loss, fatigue, and changes in appetite and sexual drive, among others (Skeel, 2011; Tipton, 2011). Many of these side-effects also directly affect perceived well-being and quality of life, and contribute to psychosocial distress. However, when experienced in combination, the synergistic effects of these treatment sequelae exacerbate such effects on the individual. Additionally, cognitive changes secondary to chemotherapy (e.g., “chemo-fog” or “chemo-brain”) have been identified, including problems with attention and concentration (Ahles, Root, & Ryan, 2012; Cimprich, 1993). Chemotherapy has been described as the most burdensome of cancer treatment options (de Haes & Knippenberg, 1985).

Toxicities and side effects secondary to chemotherapy for cancer affect individuals in numerous facets of their everyday lives. Chemosensory change—in smell and taste, for example—have been reported to negatively affect the experience of food and cooking, resulting in feelings of distress and withdrawal from social situations (Bernhardson, Tishelman, & Rutqvist, 2007). Additionally, individuals who experience peripheral neuropathy have discussed disruption to normal social patterns, family roles, and activities of daily living (Bakitas, 2007). Moreover, experiencing nausea and vomiting has been described as a complex symptom that may influence coping, and can further complicate eating, maintaining a normal diet, and participation in social situations, including activities of daily living (Molassiotis, Stricker, Eaby, Velders, & Coventry, 2008). Furthermore, pain has also been identified as a problematic side effect of chemotherapy regimes (e.g. Farquhar-Smith; Scialdone, 2012), yet while it is noted to vary considerably from individual to individual (Polomano & Farra, 2006; Siefert, 2010), the impact on one’s well-being and quality of life remains an important concern. And finally, Mathieson and Stam (1995) and Zebrack (2000) have discussed the processes of renegotiating one’s perceptions of his/her social roles and identity following treatment for cancer.

While these examples present only a brief snapshot of current evidence and knowledge relative to treating cancer with chemotherapy, it is evident how treatment toxicity and its side effects can exacerbate distress and diminished well-being and quality of life. Overall, while myriad advances have been made in how cancer is treated, managing toxicity and side effects of chemotherapy remains an important concern for trying to decrease the impact of treatment and manage well-

being and quality of life (Tipton, 2011). Consequently, finding novel ways to manage or reduce the extent and impact these symptoms *without* relying on additional pharmaceuticals could be highly desirable. Therefore, the present work is directed toward investigating how NREs might help mitigate the impact of chemotherapy. The following section draws from all of the previous sections to synthesize a rationale and purpose for this investigation.

## 1.7 Rationale and Purpose

The research reported in subsequent portions of this treatise has been developed and informed by biophilic discourse. In doing so, and based on theoretical and data-driven literature, an assumption has been accepted that while individual differences in environmental preference exist, it is likely that most individuals have some affinity for nature and natural processes. Assuming a biophilic tendency in the majority of humans, this study is predicated on the assumption that NREs are likely to promote restoration along predictable physiologic, affective, and attentional pathways, as well as potentially modulating broader, *global* effects on one's general health and well-being. Next, individuals who receive chemotherapy for cancer treatment experience myriad sequelae manifest in complex relationships affecting physical, psychological, and social processes. Therefore, given that restorative responses to NREs have been reported in healthcare contexts and clinical populations, there exists the potential for promoting health and well-being in individuals receiving chemotherapy by fostering experiences with NREs. However, there exists a potential disconnect at the point of translation from what is known about PEF and ART in the RE literature to the experiences and preferences of individuals treated for cancer. Stated quite simply, does the potential exist that experiences construed as restorative by "healthy" individuals are construed as restorative in individuals treated for cancer also?

The restoration literature has advanced in a relatively short period of time on the assumptions of PEF and ART—assumptions which are believed to have considerable merit. The potential problem, however, is that the vast majority of the work advancing PEF and ART has been based on relatively narrow samples of research subjects, typically university students (e.g., Berto, 2005; Hartig et al., 2003; Tennessen & Cimprich, 1995; Ulrich et al., 1991, etc.) or young adults who are often male (Bowler, Buyung-Ali, Knight, & Pullin, 2010). In contrast, much less work has

explored the assumptions and implications of PEF and ART in healthcare contexts and illness populations, and less still in oncological contexts (notable exceptions include Cimprich [1993] and Cimprich & Ronis [2003]). Thus, given the well-documented physical, psychological, and social impacts of cancer and its treatment with chemotherapy, it is worth investigating how individuals treated with chemotherapy construe NREs.

As such, it may be possible to identify whether the same settings predicted to be NREs according to PEF and ART are also considered to be restorative for this population. Specifically, the present study assumes that it is likely that some degree of a biophilic tendency exists in the majority of people and that NREs can in fact promote restoration. However, it is possible that the experience of confronting cancer, chemotherapy-related toxicities, and altered perceptions of reality following these processes could affect the definition and alignment of personal constructs in these individuals. In PCP terms, and consistent with the assumptions outlined by the range and experience corollaries in particular, it is possible that the experience of being treated for cancer could impact one's constructions of an NRE and, further, that these constructions could differ from healthy individuals. That is to say that the experience of cancer and chemotherapy could influence one's values, motives, and behaviours to the extent that they construe NREs differently than before their diagnosis and treatment, or differently from "healthy" peers.

While there exist a number of similarities in the experiences of disease, treatment, and associated sequelae, each person's experience of his/her cancer diagnosis and chemotherapy process is unique to that individual. Thus, by explicitly acknowledging such personal factors and individuals differences it is, therefore, necessary to employ a methodological approach that respects these differences. Similarly the methodology of choice must be consonant with the ontological and epistemological assumptions that support the theoretical perspectives and intentions of the enquiry. By definition, PCP and the associated repertory grid technique support the unique experience and perspective of the "individual" (Brown & Chiesa, 1990) and, thus, are philosophically and methodologically congruent with my enquiry as I have conceptualized it. This study is exploratory and, therefore, no formal hypotheses about the nature of the construct frameworks of individuals treated for cancer with chemotherapy were

posited. Instead, this study sought to explore how individuals treated for cancer with chemotherapy construed NREs in the hope that restorative experiences related to nature and the environment may be maximized for these individuals. To this end, PCP and the repertory grid technique support an investigation of individuals' personal constructs. Thus, the purpose of this enquiry is to explore how individuals treated for cancer with chemotherapy construe NREs.



## Chapter 2

### 2 Method

#### 2.1 Participants

This study sought to include a heterogeneous sample of adult cancer survivors who had received chemotherapy for a cancer diagnosis (herein referred to as the “treatment group”). The inclusion criteria were purposefully designed to be broad: 1) adults over the age of 18 who had completed chemotherapy within the last 18 months, and 2) who were comfortable having a conversation in English were invited to participate. Beyond having received chemotherapy, neither additional treatment modalities including concomitant surgery and/or radiation, nor the anatomical site of one’s diagnosis disqualified one from participating. However, individuals were excluded from participation if they had uncorrected vision problems or if their treatment was considered palliative. Individuals who were actively undergoing chemotherapy were not selected for participation because of the interest to capture each individual’s perspective on NREs as they reflected on their experiences of having been diagnosed and treated for cancer.

A second group of individuals also was recruited to provide gender and age-matched comparisons (herein referred to as the “comparison group”). This meant that every individual in the treatment group was “paired” with an individual from the comparison group who was the same gender and was within five years of age. This group of individuals was included to permit comparisons between an individual who had received chemotherapy and one who had not. Comparisons between matched pairs was considered important because the broad inclusion criteria meant that pertinent individual-level information could be lost and decontextualized when data were collapsed for broader nomothetic analyses. Thus, the inclusion of gender- and age-matched comparisons provided a point of comparison between an individual treated for cancer and an otherwise “healthy” individual. Further, the comparison group was included to provide an approximation of “normal” construct systems relative to perceptions of NREs, which in turn permitted the comparison of these data with the underlying perceptual assumptions of PEF and ART.

Individuals in the treatment group were recruited in a number of ways, including through their circle of care at the London Regional Cancer Program, recruitment posters displayed at Wellspring Cancer Support centres in Toronto and London, and by email communication to facilitate snowball sampling via individuals already included in the study. Individuals in the comparison group were recruited primarily by email and through snowball sampling of friends and relatives of individuals already enrolled into the treatment group, as well as through acquaintances of this researcher and my supervisory committee. However, no family members or friends with whom I shared a close interpersonal relationship were included in either the treatment or control groups. The Health Sciences Research Ethics Board at Western University approved this study (protocol #18703E, Appendix B).

## 2.2 Data Collection

This study explored constructions of NREs from the theoretical perspective of PCP, thus, relying on *constructs* as the conduits of perception and meaning used by each individual to make sense of a NRE. As previously discussed, PCP offers a unique perspective on how phenomena are interpreted and how these interpretations change over time, as well as providing its own philosophical orientations that ground PCP (i.e., constructive alternativism). Accordingly, Kelly (1955) also developed a technique to explore an individual's construct framework, a method termed the "repertory grid."

### 2.2.1 Repertory Grid Technique

The repertory grid technique was developed by Kelly (1955) as the primary method for representing and analyzing construct frameworks according to PCP. A completed repertory grid is a data matrix containing the opposing poles for each construct elicited during the interview process (e.g., *hot—cold*), as well as construct ratings for every element being construed. In PCP, a construct is the bi-polar judgement one uses to construe an event, while an element is that event which is being construed. Essentially, an element is the stimulus, event, person, or phenomenon about which a judgement is being made. For example, in Kelly's original development of the repertory grid (1955), the elements were role titles (i.e., individuals) from an interviewee's life, such as a mother, father, a liked or disliked teacher, an intelligent person,

etc. Thus, a repertory grid can be used to directly elicit from an individual the constructs s/he uses to construe elements within a given range of convenience, and to explore meaning and relationships among these constructs and elements.

Data in a repertory grid are recorded according to ratings one provides for a given element based on an elicited construct. Constructs are commonly generated through the process of *triadic elicitation*, whereby three elements are selected and an individual is asked to identify a way in which *two* of the elements are similar, and, thereby, different from the third. The similarity identified then serves as one pole (similarity pole) of the construct. The individual is then asked how the third element is different from the pair, thus, identifying the opposing construct pole (difference pole). The example I provided to participants in the present study suggested that a cup of coffee, a cup of tea, and a cup of milk might elicit the constructs *hot—cold* or similarly, *dark—light* based on the tea and coffee being construed as similar and thereby different from the milk. After identifying a construct, elements can be rated according to that construct. Originally, Kelly described the rating process in a binary fashion, meaning that each element aligned with one of each construct's poles; however, scales have since become more common, often ranging from 1-5 or 1-7 (Fransella, Bell, & Bannister, 2004; Jankowicz, 2004). In a typical interview the construct elicitation process continues presenting new triads of elements until the individual is no longer able to generate novel constructs.

### 2.2.1.1 Elements

Elements in this study were chosen a priori, while the constructs were elicited directly from each individual through the interview. Participant ratings were made using a seven-point scale, where 1 always aligned with the similarity pole of a given construct, and 7 aligned with the difference pole for that construct. In total, 11 elements were presented to each participant during the interview. Ten of these were photographs of various NREs, while the eleventh was an "imagined ideal" NRE (Id) elicited directly from the participant (Home et al., 2010; Jankowicz, 2004). Predetermining the elements to be construed using the repertory grid is commonly practiced when one is interested in constructions of a particular range of known elements—NREs, in this case—as well as when multiple grids will be analyzed (Fransella et al., 2004; Jankowicz, 2004).

The 10 a priori elements (Table 1) were purposefully selected to span the continuum of content within a potential NRE as predicted by the RE literature, meaning that some photographs were selected because they were "good" representations of an NRE. On the other hand, other photographs were selected because they were not typical representations of an NRE. However, all elements included varying degrees of nature. Thus, participants were asked to construe elements that spanned a range of potentially restorative settings, permitting the opportunity for a hierarchy of preferred elements to emerge.

The set of photographs was selected to include a variety of environmental features, forms, and flora generally representative of the landscape in southern Ontario (e.g., different deciduous and coniferous trees, bodies of water, flowering plants, hills, etc.). Additionally, some photographs depicted settings that reflected obvious human influence and examples of the built environment, including paths, roads, cars, high-rise and low-rise buildings, and people. Overall, there was a high degree of variability among the photographs, which in turn allowed participants to sample highly differentiated content during construct elicitation. However, the photographs still comprised a relatively homogeneous sample, or range of convenience, meaning that none of the elements were so different or unique that they might not be considered examples of natural places. Heterogeneous samples of elements can complicate the construing procedure because they can exist outside of one's range of convenience for a given context (Fransella et al., 2004), thus, rendering the constructs inappropriate and/or irrelevant. As such, while the photographs displayed varying degrees of natural and built elements, they all displayed content expected to fit within a range of convenience related to nature and natural spaces in Ontario. Further, none of the photographs contained visual information that would have been considered "novel," instead depicting common representations of parks, trails, open space, urban green space, and natural features of the landscape that are commonly associated with Ontario's natural environment. In fact, most photographs were captured within 300 km of each individual's home.

The imagined ideal (eleventh element) was elicited from each participant so that a "gold standard" was included in each set of elements. Thus, participants were able to select not only the content and environmental features considered most restorative for them, but they were also able to describe a setting that could exist anywhere in the world, or even in their imagination.

Table 1  
A Priori Repertory Grid Elements

| Element Name | Photograph   |
|--------------|--|
| A            |    |
| B            |  |



---

Element Name

Photograph

---

C



D



E



---

Element Name

Photograph

---

F



G



H





---

| Element Name | Photograph  |
|--------------|---|
| I            |   |
| J            |  |
| Id           | <i>[imagined ideal natruual restorative environment]</i>                            |

---



The imagined ideal also ensured that each individual was able to construe an environment that might be very different from the pre-selected set of elements. Therefore, the imagined ideal provided a point of reference within a range of convenience for the type of setting and natural elements most important to that individual's construction of a NRE. Consequently, the inclusion of an imagined ideal ensured that the constructs elicited and ratings provided were not restricted within a given range of convenience determined by this researcher, but could better reflect each individual's uniquely personal constructions of a NRE.

#### 2.2.1.1.1 Selection of elements

All photographs (i.e., "a priori elements") (Table 1) were taken in southern Ontario over a number of years between May and August, from 09:00 to 16:00, and were captured using a digital camera (Panasonic DMC-FZ7) from a standing posture. Photographs were cropped if necessary and printed at a size of 8 x 12 inches before being applied to a sturdy piece of construction paper. Aperture and shutter adjustments were made in camera to capture each photograph at 0 EV. No adjustments or digital manipulations were applied to any of the photographs. Each of the photographs was intended to reflect a common, unmodified view within each given setting. Photographs in this study were selected by this researcher, and were based on my immersion in the theoretical and practical RE literature over the past seven years. They were selected to represent a broad, yet typical scope of settings found in southern Ontario, and to include varying degrees of wild nature and human influence. Table 2 lists each a priori element and describes the predicted restorative and non-restorative features.

### 2.3 Procedure

Interviews were scheduled in cooperation with each individual and occurred in a quiet setting of each person's choosing. Most interviews were conducted in the participant's home, while some were conducted in meeting spaces at Western University, at a local coffee shop, or in a public library. Individuals were provided with the letter of information beforehand, but were not formally enrolled into the study until providing informed consent at the start of each interview. Interviews were audio recorded directly to a laptop computer. Interviews were conversational in nature (Fransella & Bannister, 1977) and based on a semi-structured guide (Appendix C; used

Table 2  
Element Characteristics

| Element | Description  | Anticipated restorative potential  |
|---------|--|--|
| A       | Urban park with no prominent human artefacts, but obvious human influence  | Relatively typical RE as usually described in literature; anticipated to be generally restorative overall                                  |
| B       | Garden in urban park offering unique colour and floral arrangements; no human artefacts  | Ambiguous if a planned or wild space; typical of REs described for use as trails; anticipated to be generally restorative overall          |
| C       | Wide-open marsh land in provincial park; no human artefacts or influence; grass and ground cover not yet in full bloom; grasses are waist-high | Intended to be interpretable as either restorative or not restorative depending on one's intentions and/or preference for exposed settings |
| D       | River-side bank in provincial park bordering a medium-sized city; no human artefacts or influence  | Included water and was relatively accessible; intended to be an exemplar RE and highly restorative overall                                 |
| E       | Urban park in down town core of medium sized city; obvious large buildings, cars, and people, as well as human influence                       | Intended to represent a highly built and created RE, yet still somewhat restorative overall  |
| F       | Wooded area of conservation area completely dominated by nature and without a clear path or direction of travel; no human artefacts            | Intended to represent a completely wild and natural space including diverse ground textures and trip hazards; anticipated to be not        |

|    |  |   |
|----|--|---|
|    |  | restorative overall   |
| G  | Rocky shore in national park, including thick forests and vast body of water conveying generally wild and rough terrain; no human artefacts                  | Intended to represent an entirely wild space that while containing the preferred elements of an NRE, also presented trip and fall hazards; anticipated to be either restorative or not restorative based on one's preference/experience |
| H  | Shore of a small and calm lake surrounded by forests; no human artefacts   | Intended to be an entirely natural and calm scene including generally preferred components of an RE, though lacking terrain conducive to walking; anticipated to be generally restorative overall                                       |
| I  | A quiet urban park including family homes and few people; obvious human influence and artefacts including cars   | Intended to represent a mix of an obvious urban space and a natural space obviously created and maintained; anticipated to be generally restorative overall   |
| J  | An obvious hiking/walking path in a forest like setting in a provincial park; includes obvious human influence or presence and direction of travel/purpose   | Intended to represent an entirely natural setting with a purpose, generally safe path, and potential to encounter other people; anticipated to be generally restorative overall   |
| Id | To be determined by each participant, and could be a real or fictitious place, but including all those natural elements contributing to it being restorative | Intended to contain those natural elements most highly valued by that individual; anticipated to be highly restorative overall  |

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mostly to ensure a standard set of instructions). Interviews were conducted freely and progressed organically, permitting each participant and me to build a rapport and discuss broader issues not directly related to the repertory grid task. This was an important aspect of the interviews because it allowed me to ask personal questions and for us to discuss personal experiences and histories, thus, helping to contextualize and elaborate my understanding of each individual's construct framework. Conversational interviews were important because a repertory grid is based on one's own language, and it was imperative that I understood clearly what each participant was describing. Recalling the sociality corollary of PCP, I acknowledge that the purpose of each interview was for me to construe and interpret the constructs of each participant, and that a repertory grid provides an approximation of one's construct framework, and not an exact representation of that framework (Fransella et al., 2004; Jankowicz, 2004).

Participants were instructed that they would be making judgements about similarities and differences among various photographs of natural scenes, and that they would be rating each photograph using a seven-point scale. Further, individuals were informed that I was interested in their own thoughts, descriptions, and language, and that there were no "right answers." Moreover, I explained that while I would ask for clarification often, this was to ensure that I understood their descriptions, and not to "put words in their mouth" or correct their descriptions. Last, I stressed that this research could be different than other research they might have participated in because I considered the collected data to be *theirs*, that they "owned it," and that they could change their minds or, if necessary, pause the recorder and go off the record. This approach is not necessarily as common in the repertory grid literature as it is in other qualitative methodologies, but I considered it important to reflect the interpretive undertones of constructive alternativism and PCP, and to respect each individual's story. I was never asked to turn the recorder off, and no one wished to alter his/her data either during or after completing the interview.

Individuals were informed that the general theme of the interview would be "natural restorative environments," and that this was meant to be interpreted freely by them, meaning that "natural" could relate to a space existing wholly in a natural environment, such as the middle of the woods or another setting, such as a city park or backyard garden. Similarly, they were instructed that

“restorative” could mean any type of restoration, such as physical, emotional, or psychological, and I suggested they could relate it to the type of place one might seek when having a “bad day.” To elicit their imagined ideal, each participant was asked to describe their ideal “natural restorative environment” in terms of their senses. In some cases, individuals described dynamic settings, meaning that they described walking through the setting, or that they would emerge somewhere after walking through the environment. However, I asked individuals to think about being stationary, and to only describe the content from one perspective, therefore reflecting the two-dimensional perspective of the photographs. No participant experienced difficulty describing his or her imagined ideal. In many cases, these places were elicited very quickly and described in great detail.

After describing the imagined ideal NRE the interview was carried out in the following fashion: presentation of new triad, discussion and construct elicitation, element ratings, new triad of elements. Triads were randomly generated, and construct elicitation for each triad was based on asking the participant to identify an important way that two elements were similar and, thereby, different than the third. After eliciting the similarity pole, participants were then asked how the third element was different (Fransella et al., 2004). Each elicitation phase included a discussion of the meaning behind the elicited construct poles and the broader idea they represented. If this construct had been identified previously in the interview I then asked whether there was a *new* important way that two of the three elements were similar. Further, in the case where I interpreted a construct to be similar to one already discussed, I asked each individual if they were discussing the same essential thing as before or whether this construct was different, and if so, how? After establishing a novel construct and ensuring that I sufficiently understood the construct’s meaning, the similarity was recorded on the left side of the grid and the difference on the right side, establishing the anchors for each scale. Participants were then asked to identify which pole of the elicited construct they preferred (Fransella et al., 2004). Next, each of the elements from the triad were rated from 1 to 7 (1 = similarity pole, 7 = difference pole) followed by the rest of the elements including the imagined ideal. Ratings were provided orally by each participant and recorded by me (Fransella et al., 2004), thus ensuring that elements were not compared to one another for each rating. A blank sample grid which includes a basic overview of

the procedure is provided in Appendix D. Participants were able to skip a triad during the interview if s/he felt unable to identify a novel construct, and in this case, the next triad was assessed. The construct elicitation process was considered finished when the individual indicated that s/he no longer wished to continue, could not offer any new constructs, or if two triads were skipped consecutively. Before completing the interview each participant was asked to make one final set of ratings according the global construct *overall restorative—overall not restorative*. In general, interviews were expected to last approximately 90 minutes.

## 2.4 Data Analyses

Analyses in this investigation were planned to proceed from an idiographic level to a nomothetic level. Idiographic and nomothetic data from the treatment group are presented first, and in isolation from the comparison group, congruent with the purpose of this investigation. To determine if meaningful differences existed between individuals in the treatment group, basic indices were computed to determine if it would be inappropriate to collapse individual data into group-level data. Analyses of repertory grid data were computed using the research version of the Rep 5 Conceptual Representation Software package (Cobble Hill, British Columbia).

### 2.4.1 Lopsidedness

First, measures of central tendency, including the mean, standard deviations, and ranges of construct ratings were calculated and examined to determine if any constructs were “lopsided” (Fransella et al., 2004). Lopsidedness relates to one pole of a given construct being used or relied on substantially more than its contrasting pole. While Fransella et al. (2004) point out that lopsidedness is to be expected because ratings are being made relative to one’s personal preferences, they add that such metrics provide insight relative to how the elements are distributed across each construct and whether the two construct poles are used relatively equally. Because this investigation was primarily concerned with examining group-level data, construct grand means were calculated for each individual and compared. Attempting to compare individual construct means across participants would have been inappropriate because such means are only meaningful relative to other construct means from within the same grid provided by that individual. Therefore, grand means were compared because they better

captured the essence of one's grid and his/her ratings and were more appropriate to compare across participants.

## 2.4.2 Variance of First Factor

A second individual-level metric that can offer insight into the construction patterns of individuals is the percentage of variance accounted for by the first factor (PVAFF). The PVAFF score reports the variance accounted for by the first factor based on a spatial rotation of the data. It is often reported as a measure of "cognitive complexity" (Baldauf, Cron, & Grossenbacher, 2010; Fransella et al., 2004; Jones, 1954). Each grid from the treatment group was analysed using the PrinGrid analysis function in Rep 5, which computes a "double-centred matrix of distances between elements with all construct ranges scaled to be the same" (Gaines & Shaw, 2009a, p.3-6). The PrinGrid analysis in Rep 5 is based on Slater's principal components analysis (Slater, 1964), which has been described as more accurately referred to as a singular value decomposition (Fransella et al., 2004). While "factor" is part of the common vernacular for such analyses, the term "component" is used here synonymously to reflect the way data are displayed in Rep 5. Baldauf et al. (2010) noted that higher PVAFF scores are indicative of lower construct differentiation because of the relative importance or meaning of the first component in one's construing. That is, higher PVAFF values indicate more unidimensionality (Hardison & Neimeyer, 2012) of one's grid—meaning relatively lower differentiation (i.e., lower complexity) because that factor is accounting for a greater proportion of one's overall construing (Caputi, Bell, & Hennessy, 2012; Fransella et al., 2004). Conversely, a lower PVAFF score represents more multidimensionality in one's grid (Hardison & Neimeyer, 2012) and, thus, a more complex construct framework (Caputi et al., 2012; Fransella & Bannister, 1977), because one relies more equally on multiple independent constructs to construe elements. Ultimately, the PVAFF is indicative of the relative importance of the first factor (and the constructs associated with it) in one's grid (similar to a traditional factor analyses). The convergent validity of the PVAFF statistic with other indices of differentiation and complexity has been described previously and supported (Baldauf et al., 2012).

### 2.4.3 Individual Cluster Analyses

In order to determine the degree to which elements were construed similarly or differently across individuals in the treatment group, hierarchical cluster analyses were performed on the individual grids. Cluster analyses sort grid data to bring similar elements and constructs together in a hierarchical representation based on how ratings are matched (Gaines & Shaw, 2012). Cluster analyses were performed for each individual grid using the Focus algorithm (Shaw, 1980) provided via Rep 5. Grids were analyzed according to the default parameters in Rep 5 (Gaines & Shaw, 2009a) using a power of 1.0 for the Minkowski metric, which computes distances using the “city-blocks” method (i.e., absolute distances; Borg & Groenen, 2005; Gaines & Shaw, 2009a). Cluster analyses were also completed using “interior” matching so that similar items (constructs or elements) would be sorted adjacently, thus aiding visual interpretation (Gaines & Shaw, 2009a).

### 2.4.4 Treatment Group Mode Grid

Individual grid data from the treatment group was subsequently combined into a mode grid using the SocioGrids mode grid function in Rep 5. Gaines and Shaw note that this can be an important technique for combining group data to explore conceptual similarities across elements and constructs (Gaines & Shaw, 2009b). The mode grid was generated by collecting the most highly matched constructs across all of the grids in the group based on the Focus algorithm (Shaw, 1980). As was done for the cluster analysis, the power was set to 1.0 and the default cut-off (80.00) was used (Gaines & Shaw, 2009b). The treatment group mode grid was then analysed using the same cluster analysis described above to display the highest matching elements and constructs.

Additionally, the mode grid was spatially rotated using the PrinGrid function in Rep 5. This analysis was intended to complement the cluster analysis by providing insight into how mode grid constructs loaded onto the extracted components, as well as how the elements would orient in the resultant conceptual plot. Gaines and Shaw (2009b) note that computing a PrinGrid of a group’s mode grid is analogous to performing a generalized Procrustes analysis. However, they



also note that this method has the advantage of not introducing artificial ratings because the mode grid is a composite of the individual grids that are used to compute it.

### 2.4.5 Treatment and Comparison Group Analyses

Finally, data from both groups were compiled into “composite” grids using the RepSocio function in Rep 5. The two resulting grids (one for each group) contained every construct and all of the ratings from each individual participant, respectively. Next, these two grids, each containing the raw data from their group members, were examined using the “compare” function in Rep 5. This function applies the Focus algorithm from Rep 5 to the two grids, thus, linking constructs or elements from each group based on the degree of their similarity. Potential differences in how NREs were construed between the two groups would be evaluated based on this analysis.

## 2.5 Reliability and Validity

Determining the psychometric properties of reliability and validity for the repertory grid technique is difficult to negotiate and has been debated in the literature. In fact, Walker and Winter (2007, p.461) note that Kelly (1955) was relatively “dismissive” of concerns related to reliability and validity, and given that there is no one standard method or form of grid to speak of, general claims about reliability and validity are, in a matter of speaking, inconsequential. This point is echoed by Fransella et al. (2004), who described that “... there is no such things as *the grid*” (p.134, emphasis in original) because there exist myriad ways a grid can be constructed and completed. Moreover, Fransella et al., (2004) discuss that “reliability” is further complicated because the repertory grid is not a “test,” but instead, simply a technique. This paradox of assessing the reliability of the repertory grid technique is elegantly captured by Fransella et al. (2004) who state: “The idea of a static mind is a contradiction in terms” (p.133), which reflects Kelly’s (1955) assertion that man is in constant motion. Thus, expecting that the repertory grid technique to deliver the same information (i.e., reliable) over time is nearly antithetical to the fundamental assumptions of PCP. However, despite obstacles to using traditional interpretations of reliability and validity, psychometric investigations of analyses and

interpretations of completed grids have shown relatively high degrees of “reliability” (e.g., as compiled by Fransella et al., 2004) and “validity” (e.g., Baldauf et al., 2010).

## 2.6 Displaying, Discussing, and Interpreting Results

When presenting and discussing the results of this investigation, the following naming convention has been adopted: constructs are displayed in italics as “*similarity pole–difference pole*” and an asterisk (\*) indicates the preferred pole. In the case where neither pole was preferred, an accent (^) identifies the pole that would be preferred if one was forced to choose one over the other. The *overall restorative–overall not restorative* is displayed as *overall+–overall-* (or simply *overall*), where the *overall+* pole is always assumed to be preferred. Further, reference to individuals will be displayed as their identification number (e.g, 01, 02, ... 30) including the suffix “x” or “c” denoting either treatment group or comparison group, respectively. The two groups are referred to by the shorthand Tx (treatment group) and Cr (comparison group) in tables and figures. Thus, construct data from the repertory grids will be presented as: (02x)*park-like–natural & wild\**, for example. While this convention is cumbersome in text, it reflects the way data are output via the Rep 5 software package and, therefore, will help to ensure data are consistently displayed and presented throughout the investigation.

Finally, two cardinal points of reference within the grids will be of particular interest to orient these descriptive analyses: the imagined ideal NRE (Id) and the *overall* construct. While the Id will differ across individuals, it will serve as a primary point of reference and comparator because it represents the perfect manifestation of a NRE for any given individual. Consequently, exploring how the Id relates to other elements in each grid and across grids will provide a “gold standard” from which to interpret how the elements are sorted and any relationships among them. Second, the *overall* construct provides a “standardized” assessment of potential restorativeness relative to other constructs and, thus, can similarly be used as the cardinal point of reference and comparator among constructs. Therefore, the results of this analysis will focus primarily on the how the Id and *overall* construct relate to the individual ways in which individuals construe NREs.

## 2.7 Positioning Statement

In keeping with the tenets of constructive alternativism and the nature the PCP framework (Kelly, 1955), I believe it important to acknowledge my role in this research process. In PCP, the sociality corollary describes the underlying interpretive social processes involved when one tries to construe the constructions of another. This process is fundamental to each of the interviews I conducted. Thus, it is important to acknowledge my role in how data for this dissertation were *co-created* through my discussion with each participant and subsequently analyzed and presented. Practicing *reflexivity* can help me acknowledge this role and make explicit my own personal history and biases, as well as ensure greater transparency in reporting the findings of this work. Reflexivity describes a process of critical self-awareness practiced by a researcher to realize one's own history, assumptions, and biases that cannot be separated from the research processes, and to acknowledge these in presentation of the research as a measure of transparency (Finlay, 2002). It has been advocated previously by Neimeyer (2002) when using the repertory grid technique, as well as being fundamental to conducting transparent, ethical, and rigorous research in the qualitative research community (e.g., Finlay, 2002; Macbeth, 2001). Thus, since constructivist ontological and epistemological perspectives inform constructive alternativism and PCP, and further to acknowledge my role in the research I describe herein, I have included a reflexive positioning statement in Appendix E, while Appendices F, G, H include copies of the letter of information, recruitment poster, and demographic forms, respectively.

## Chapter 3

### 3 Results

#### 3.1 Participants

In total, 30 participants were enrolled in and completed repertory grid interviews as part of this study. Fifteen individuals who had received chemotherapy for a cancer diagnosis (treatment group) and 15 gender- and age-matched ( $\pm 5$  years) individuals who had never been diagnosed with cancer (comparison group) participated. Of the 15 individuals in the treatment group, 11 were female (73%); the mean age was 43.18 years (SD 15.65), and the ages ranged from 23.67 – 70.0 years. The mean age of the comparison group was 42.45 years (SD 16.40) with an age range from 22.0 – 74.3 years. Diagnosis and treatment-related information for the treatment group, as well as other basic demographic information for both groups are presented in Table 3. Table 4 displays information about whether individuals considered themselves to be an “outdoors” type of person and the individual value they placed on their relationship with the natural environment.

#### 3.2 Repertory Grid Analysis – Elicitation of Constructs

Overall, 128 constructs were elicited from the treatment group, 14 of which comprised the *overall* constructs included for every participant, except one (01x). In this case, the interview was the first one conducted in the study and the *overall* construct was missed by the investigator during the interview. One interview ended because the individual became tired, while the other 14 ended when the individual was unable to generate a novel construct through the triadic method, or two sets of triads were skipped consecutively. One hundred and thirty constructs were elicited from the comparison group, 15 of which were the *overall* constructs. All 15 interviews in comparison group were completed according to the study protocol.

Across both groups, interviews generally lasted between 60 and 90 minutes, and were most often conducted in the individual’s home. Two individuals (one in each group) spoke English as their second language, but this did not impact their ability to communicate effectively and/or

Table 3  
Participant Characteristics

|  | N (%)    | Mean (SD)     | Range        |
|--|----------|---------------|--------------|
| Treatment group                        | 15 (100) |               |              |
| Males                                  | 4 (27)   |               |              |
| Females                                | 11 (73)  |               |              |
| Age                                    |          | 43.18 (15.65) | 23.67 – 70.0 |
| Site of diagnosis                      |          |               |              |
| Brain                                  | 1 (6)    |               |              |
| Breast                                 | 4 (26)   |               |              |
| Endometrial                            | 1 (6)    |               |              |
| Hodgkin's lymphoma                     | 1 (6)    |               |              |
| Larynx                                 | 1 (6)    |               |              |
| Lymph nodes                            | 1 (6)    |               |              |
| Mediastinum                            | 1 (6)    |               |              |
| Melanoma (back)                        | 1 (6)    |               |              |
| Multiple myeloma                       | 1 (6)    |               |              |
| Nose                                   | 1 (6)    |               |              |
| Rectal                                 | 2 (13)   |               |              |
| Treatment                              | 15 (100) |               |              |
| Surgery                                | 9 (60)   |               |              |
| Radiation                              | 9 (60)   |               |              |
| Chemotherapy                           | 15 (100) |               |              |
| Time since diagnosis (years)           |          | 1.84 (1.01)   | .75 – 5.5    |
| Time since treatment completed (years) |          | .84 (.49)     | .08 – 1.58   |
| Highest level education completed      | 15 (100) |               |              |
| Some college/post-secondary            | 0        |               |              |
| College diploma                        | 6 (40)   |               |              |
| Apprenticeship / trade school          | 1 (6)    |               |              |
| Bachelor's degree                      | 5 (33)   |               |              |
| Master's degree                        | 1 (6)    |               |              |
| Professional degree                    | 1 (6)    |               |              |
| Doctorate                              | 1 (6)    |               |              |
| Household income                       | 15 (100) |               |              |
| Less than \$25,000                     | 4 (26)   |               |              |
| \$25,000 - \$40,000                    | 2 (13)   |               |              |
| \$40,001 - \$55,000                    | 1 (6)    |               |              |
| \$55,001 - \$70,000                    | 0        |               |              |
| \$70,001 - \$85,000                    | 0        |               |              |

|                                   | N (%)    | Mean (SD)     | Range       |
|-----------------------------------|----------|---------------|-------------|
| Greater than \$85,000             | 2 (13)   |               |             |
| Prefer not to answer              | 6 (40)   |               |             |
| Comparison group                  | 15 (100) |               |             |
| Males                             | 4 (27)   |               |             |
| Females                           | 11 (73)  |               |             |
| Age                               |          | 42.45 (16.40) | 22.0 – 74.3 |
| Highest level education completed | 15 (100) |               |             |
| Some college/post-secondary       | 2 (13)   |               |             |
| College diploma                   | 4 (26)   |               |             |
| Apprenticeship / trade school     | 0        |               |             |
| Bachelor's degree                 | 4 (26)   |               |             |
| Master's degree                   | 2 (13)   |               |             |
| Professional degree               | 2 (13)   |               |             |
| Doctorate                         | 1 (6)    |               |             |
| Household income                  | 15 (100) |               |             |
| Less than \$25,000                | 3 (20)   |               |             |
| \$25,000 - \$40,000               | 0        |               |             |
| \$40,001 - \$55,000               | 3 (20)   |               |             |
| \$55,001 - \$70,000               | 1 (6)    |               |             |
| \$70,001 - \$85,000               | 1 (6)    |               |             |
| Greater than \$85,000             | 3 (20)   |               |             |
| Prefer not to answer              | 4 (26)   |               |             |

Table 4

## Relationship with Nature

|                                    | N  |
|------------------------------------|----|
| Treatment group                    | 15 |
| Outdoors person                    |    |
| Yes                                | 7  |
| Somewhat                           | 7  |
| No                                 | 1  |
| Value of relationship with nature* |    |
| None                               | 0  |
| A little                           | 1  |
| Some / moderate                    | 4  |
| A lot                              | 9  |
| Comparison group                   | 15 |
| Outdoors person                    |    |
| Yes                                | 7  |
| Somewhat                           | 7  |
| No                                 | 1  |
| Value of relationship with nature  |    |
| None                               | 1  |
| A little                           | 1  |
| Some / moderate                    | 5  |
| A lot                              | 8  |

*Note:* \* n = 14 where there were missing data in the analyses.

complete the interviews. Overall, 14 individuals (47%, seven in each group) considered themselves to be an “outdoors type of person,” and 26 (87%, 13 in each group) individuals indicated that they placed “some/moderate” or “a lot” of value on their relationship with the natural environment (Table 4).

### 3.2.1 The Imagined Ideal

Overall, one’s imagined ideal (Id) represented the type of setting and natural content considered to be most important for that individual relative to a restorative experience. Of the 30 individuals interviewed, none found it difficult to describe their Id and, in almost all cases, similar environmental elements and characteristics were described. In nearly every case individuals described a setting that was familiar to them. Generally speaking, the typical Id elicited from these individuals was construed as a place among trees, near water, and with an open vista. Individuals further described a setting with changes in elevation, sometimes referring to mountains or geologic features, such as the Niagara Escarpment (a characteristic limestone escarpment and peninsula in southern Ontario). In describing their Id, many referred to stereotypically “Canadian” landscapes, most notably based on geography found in south and central Ontario or the Maritime Provinces. For example, individuals often described that their Id emerged from a forest-like setting containing deciduous and coniferous trees, to present a body of water with an open vista, rocky outcroppings and changes in elevation, and one that occurred on a relatively sunny day. Participants described hearing wind through the trees, bird noises, and the sound of the water, as well as perceiving clear air and fresh, natural scents, and the absence of people. Most individuals described being alone within this described space.

There were a few notable exceptions, including seven individuals (23%) who described explicitly tropical settings, such as being on a Caribbean beach or in the mountains of Costa Rica or Hawaii. However, most still described similar features or characteristics as noted above—namely water, trees, open vistas, and few, if any people. One of these seven individuals excluded water from her Id (08x), instead preferring the vista from a Costa Rican mountainside. Further, of the 30 individuals, two described being on a boat (one on a sailing boat [02x] and one in a canoe [04x]), and two individuals preferred to be at their Id at night—one at sunset (21c) and



one later in the night in the presence of a vast sky of stars (11x). Additionally, one individual described a resort-like space at a ski destination where the presence of others was important (01x). One participant described being on the beach at a tropical resort where there were few trees and resort amenities (19c). One individual described being in her Id with her partner and children (14c), three individuals described being there with their dogs (14c, 15x, 29c), and one individual described being (back) in the notably dry mountains of Iran with his family (30c).

Perhaps not surprisingly, cultural references emerged from the description of Ids. For example, one Caribbean beach and the Iranian mountains were both elicited from individuals who were born in those places and later emigrated to Canada (16x and 30c, respectively). For individuals who were born in Canada, but had traveled to tropical places, such as Costa Rica, Hawaii, or the Caribbean, there were references to the novelty and uniqueness of those settings compared to more familiar Canadian landscapes. For individuals who described Ids that were reflective of “Canadian” experiences, they often associated these places with specific outdoor experiences that would draw them to that particular setting, such as hiking, camping, canoeing, and visiting a cottage. Overall, distilling from these unique Ids the fundamental elements necessary for a natural environment to be restorative, individuals overwhelmingly described the presence of a vista, often over or near water that emerged from a forest-like place, and where the geography of the land evoked an emotion of wild and untamed nature.

Finally, only one individual described that her ideal NRE had changed as a result of her cancer experience (06x). This woman had been treated for melanoma (i.e., skin cancer) and subsequently discussed that while she would have described a sunny tropical beach before being diagnosed, she now preferred shade and protection from the sun. In fact, her desire for shade was not just a preference, but also a necessity, describing that her medical team had advised her to avoid suntans and never again suffer a sunburn. In this woman’s case she still found the potential for restoration in sunny settings, provided she was well prepared and protected. Thus, while she described her Id as *still* being a tropical beach, she also described the need for trees and shade from the sun. Interestingly, no other participants described that what they would consider ideal for restoration had changed since being treated for cancer. Although, some individuals did

relate their Ids to special places they had visited (physically or during meditation) or revisited during and/or after their treatment.

### 3.2.1.1 Companionship and Immersion in an Ideal NRE

In trying to deconstruct what was being described in each Id, there were two general categories that best differentiated the descriptions and contents of one's ideal NRE: 1) the absence or presence of others, and 2) the degree to which one was "immersed" in the NRE. First, while it was more common for individuals in the two groups to describe being alone in their Id, there were instances where a few participants explicitly mentioned the presence of others. In these circumstances, the presence of others often related to family members and/or the individual's dog. Thus, the category "companionship" was created to differentiate the Ids in which a participant described being alone from those that included a social component. Similar to a personal construct, companionship was treated like a continuum, ranging from "social" to "solitary."

Second, the category "immersion" was created to differentiate Ids that were described as being "surrounded" by nature from those that were described as being relatively more open and expansive, or "on the margin." For example, some participants described their Id as being in the middle of a forest or jungle (i.e., surrounded), while others described an open space that was separated from a "tree line," generally referring to being on a beach (i.e., on the margin). In a way, the category immersion was used to differentiate a transitional shift from an Id being *inside* a surrounded natural space, to one being *outside*, in the sense that being outside meant an Id was less enclosed by the natural content.<sup>2</sup> For example, those individuals who described an immersive setting often described vegetation (usually trees and ground cover) and geologic formations (e.g., rock) as being particularly important and "close enough to touch," as if they wanted to engage the natural content. On the other hand, individuals who preferred an Id reminiscent of a tropical beach often described having the dominant flora behind them or off to

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<sup>2</sup> It should be clarified that sand and water are considered equally as "natural" as vegetation (flora), such as trees and shrubs. Thus, one sitting on a beach in front of the ocean is essentially "surrounded" by the natural content, but not in the same sense as being in a setting with trees and other vegetation.

the side, and discussed a sense of relaxation and escape derived from not being surrounded by anything.

Boundaries to sort Ids relative to the continua of either companionship or immersion were not clearly demarcated and unambiguous. That is, Ids clearly existed along the respective continua of companionship and immersion, reflecting one's unique preferences. Figure 2 displays a plot of the 30 Ids according to the degree of companionship and immersion described by each participant. The dashed line in Figure 2 demarcates 19 of the 30 Ids (63.33%) as being wholly natural spaces that one wished to visit alone (or very nearly alone).<sup>3</sup> Details pertaining to how Ids were ultimately plotted in Figure 2 are presented in the Discussion chapter of this treatise.

### 3.3 Idiographic Analyses

The main objective of this investigation was to explore how individuals treated for cancer construe NREs and, therefore, only individual-level data from the treatment group will be described in detail in this section. Before individual grids were assembled into an interpretable composite grid that could be examined for group patterns, basic analyses were performed on grids from the treatment group to determine whether it was appropriate to collapse these data. Table 5 displays the grand mean for construct ratings, the percentage of variance accounted for by the first factor (PVAF), and the cluster-analyzed highest a priori element-Id links for each individual's grid in the treatment group. Table 5 also includes the comparative metrics from the comparison group.

#### 3.3.1 Lopsidedness

Construct means and standard deviations were computed for every construct elicited in the treatment group (data not shown). Across all 128 constructs, the overall construct mean (standard deviation in parentheses) was 3.66 (1.98), and ranged from 1.91 to 5.73. Potential lopsidedness was determined based on grand means (Table 5) calculated for each individual

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<sup>3</sup> Because the dashed line in Figure 2 bisects two groupings containing two Ids each, it was decided to count two Ids as above and two Ids as below the dashed line, thus, dividing them equally.

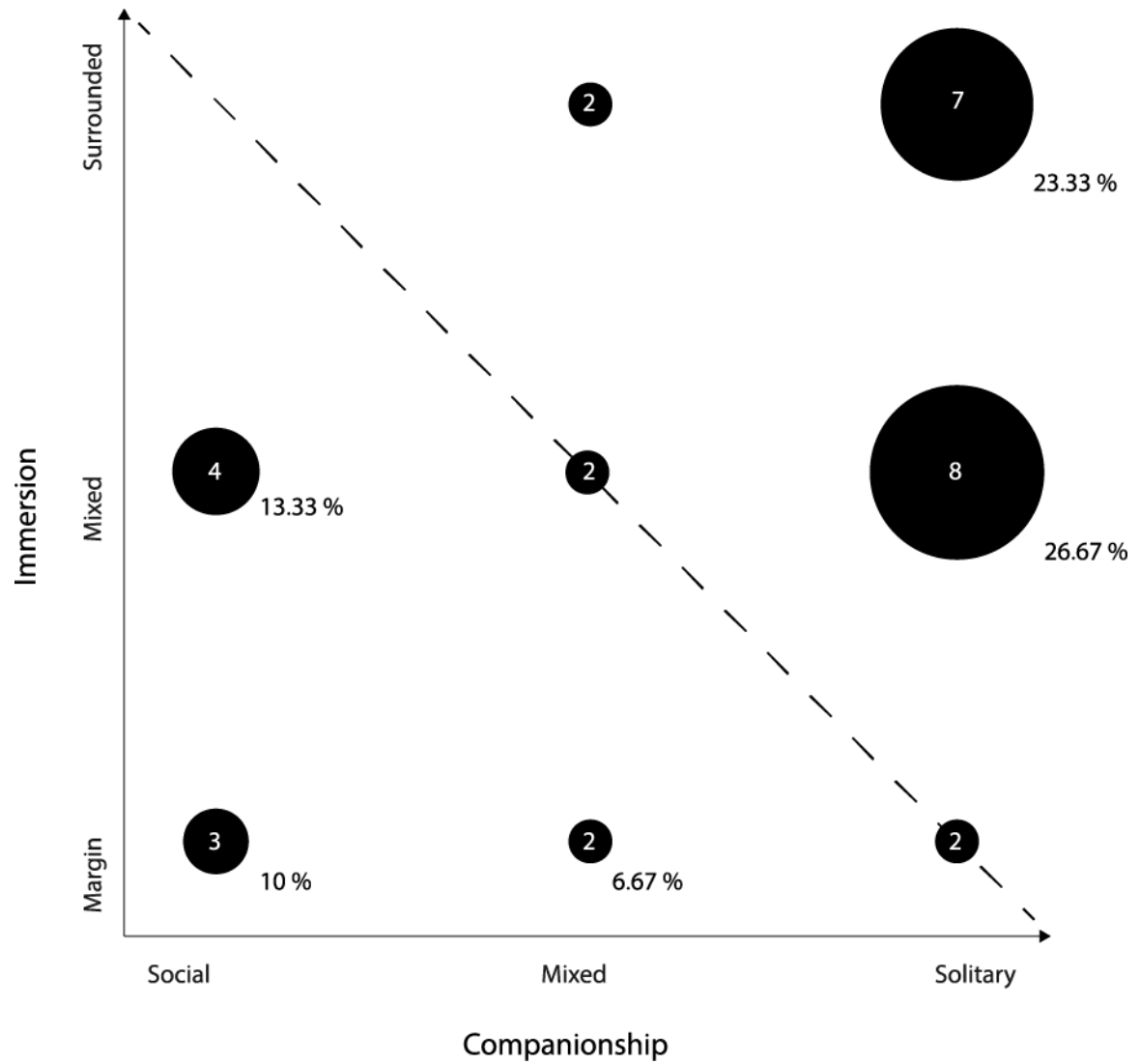


Figure 2. Immersion and companionship. Ideal natural restorative environments as described by each participant and sorted according to immersion and companionship ( $n = 30$ ). Cumulative percentages of participants grouped by each circle are provided.

Table 5  
Descriptive Statistics from Individual Repertory Grids

| Treatment Group  |                          |               |  |
|------------------|--------------------------|---------------|--|
| ID               | Constructs<br>grand mean | PVAFF (%)     | Highest a priori<br>element-Id link (% similarity) |
| 01x              | 4.42                     | 63.12         | D (64.3)   |
| 02x              | 4.22                     | 51.77         | G (77.1)   |
| 04x              | 3.60                     | 56.46         | H (77.3)   |
| 05x              | 3.56                     | 47.92         | D (83.3)   |
| 06x              | 3.62                     | 53.41         | A (75.8)   |
| 07x              | 3.87                     | 53.62         | G (76.7)   |
| 08x              | 4.24                     | 43.71         | C & J (66.7)                                       |
| 09x              | 3.34                     | 48.60         | D (95.8)   |
| 10x              | 3.28                     | 46.70         | B (77.1)   |
| 11x              | 3.98                     | 48.66         | D (81.5)   |
| 12x              | 3.61                     | 58.60         | H (87.5)   |
| 13x              | 3.83                     | 65.51         | G (96.3)   |
| 15x              | 3.75                     | 50.35         | B (83.3)   |
| 16x              | 3.73                     | 61.46         | D (88.9)   |
| 24x              | 3.27                     | 47.53         | D (80.6)   |
| Mean (SD)        | 3.75 (.35)               | 53.16 (6.56)  |  |
| Range            | 3.27 – 4.42              | 43.71 – 65.51 |  |
| Comparison Group |                          |               |  |
| 03c              | 3.95                     | 48.66         | B (84.6)   |
| 14c              | 3.61                     | 57.09         | F & H (73.8)                                       |
| 17c              | 3.80                     | 79.44         | G (96.3)   |
| 18c              | 3.55                     | 58.66         | H (90.9)   |
| 19c              | 4.01                     | 64.17         | H (81.3)   |
| 20c              | 3.66                     | 49.7          | G (83.3)   |
| 21c              | 3.51                     | 45.65         | H (90.7)   |
| 22c              | 3.83                     | 46.41         | H (83.3)   |
| 23c              | 3.71                     | 67.47         | J (83.3)   |
| 25c              | 3.44                     | 44.04         | G (88.5)   |

| ID        | Constructs grand mean | PVAFF (%)     | Highest a priori<br>element-Id link (% similarity) |
|-----------|-----------------------|---------------|--|
| 26c       | 3.51                  | 60.7          | D (83.3)   |
| 27c       | 3.45                  | 63.01         | H (90.5)   |
| 28c       | 3.23                  | 60.4          | G (83.3)   |
| 29c       | 3.03                  | 62.79         | J (97.6)   |
| 30c       | 3.94                  | 45.12         | C (66.7)   |
| Mean (SD) | 3.61 (.27)            | 56.89 (10.12) |  |
| Range     | 3.03 – 4.01           | 44.04 – 79.44 |  |

from all of the respective construct means in his/her grid. The average grand mean in the treatment group was 3.75 (SD = 0.35) and ranged from 3.27-4.42. Assuming arbitrary cut-offs of  $\leq 2$  and  $\geq 5$  as regions of potential lopsidedness (i.e., 1 unit away from each pole), no grids met the criteria for being lopsided. Therefore, no grids were considered to reflect patterns of construing that were incongruent with the elements included in this investigation or the grids of the other participants. Next, a second idiographic metric (PVAFF) was computed and investigated to determine if it would have been inappropriate to combine the grids from this group for nomothetic analyses.

### 3.3.2 Variance of First Factor

Statistics for the PVAFF were generated by computing a PrinGrid analysis for each grid in Rep 5, the results of which are displayed in Table 5. Overall, the mean PVAFF for the treatment group was 53.16% (SD 6.56) and ranged from 43.71% to 65.51%. Relative to the degree of complexity of the grids in the treatment group, individual PVAFF scores did not appear to vary to such an extent that a given individual was construing NREs in either a too complex or simple fashion. For example, comparing the grids from the two individuals with the lowest PVAFF (08x) and highest PVAFF (13x), respectively, differences in the number of constructs elicited during the interviews were minimal. For example, seven constructs were elicited from 08x (excluding the *overall* construct) and eight constructs were elicited from 13x (again, excluding the *overall* construct). Further, the mean *overall* construct ratings were 3.00 and 3.09, respectively, and the highest Id-linking a priori element within each grid was Element J and Element G, respectively. What these PVAFF values do indicate is that participant 08x construed NREs in a relatively more multidimensional manner, thus, relying on a more differentiated construct framework compared to participant 13x, whose construct framework was more unidimensional. However, these differences do not indicate that the data from these two individuals should not be combined in a group analysis. Rather, they reflect the truly individual nature of personal constructs and infinite perspectives of constructive alternativism. Therefore, one final, broader analysis of these data was conducted by examining cluster analyses of each individual's grid before their data were combined and analyzed in aggregate.

### 3.3.3 Individual cluster analyses

Hierarchical cluster analyses were performed for each individual grid using the Focus algorithm in the Rep 5, and a brief guide to interpreting a cluster analysis is provided in Appendix I. Given that this investigation intended to investigate group-level data, individual cluster analysis output is not included here. However, Figure 3 displays the output from one participant's grid (02x) as an example of the dendograms created from each cluster analysis. Table 5 displays the a priori element that linked highest with the Id from each participant's respective grid in the treatment group. Relying on each Id as the reference for maximal restoration, Element D was most often the highest linking a priori element, occurring six times in total (40%, Figure 4). Element G was the second most often linked element (three grids, 20%), followed by Elements B and H, each being linked twice (13%, respectively), while A and J were both linked with the Id in one grid each (6%, respectively). Thus, 11 of 15 participants construed a priori elements containing wild, natural content and water (D, G, H) as being the most similar to their idealized NRE. The remaining four individuals preferred elements (A, B, J), which depicted natural content lacking obvious human artefacts (e.g., buildings, paths, cars, etc.), but including evidence of human manipulation and maintenance (e.g., hiking paths, mowed lawn, etc.). None of the elements C, E, or I linked highest with an individual's Id.

Next, the cluster analyses from the treatment group were examined to determine how the *overall* construct clustered within each individual's grid (n=14). First, the *overall* construct was found to link most closely with constructs relating to differentiating elements according to their relative "ruggedness" or "wildness" in eight grids (57%, Table 6). Second, the *overall* construct linked most closely with constructs that evoked a sense of "peace" or "calm" (three grids, 21%), followed by the presence of a vista or the "warmth" of the element (two grids, 14%). Last, *overall* construct was linked most closely with water in one grid (7%). As an indication of the greatest potential for restoration, the *overall* construct was most closely associated with constructs that described relatively remote places with wild or rugged physical content, yet also were peaceful and non-threatening.



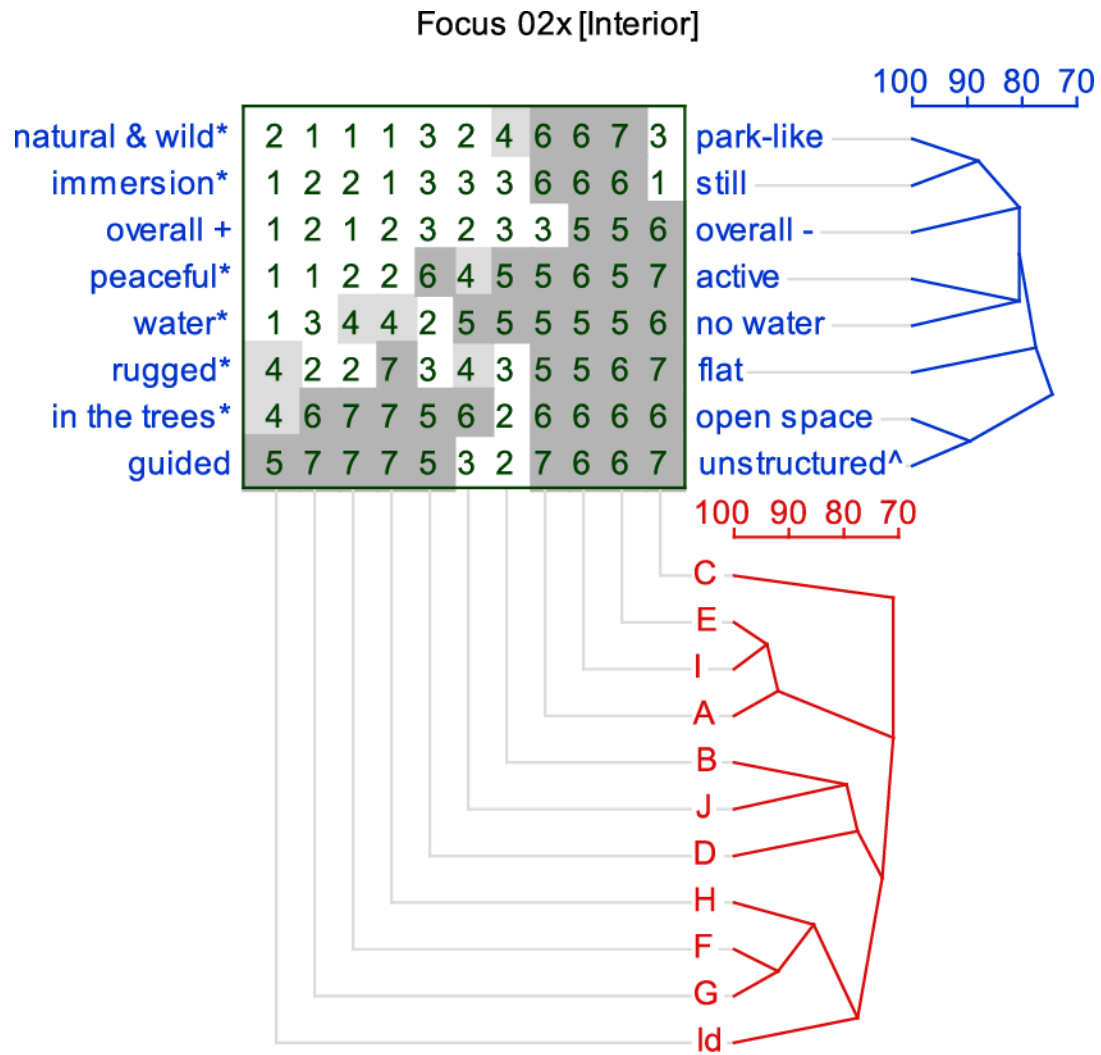
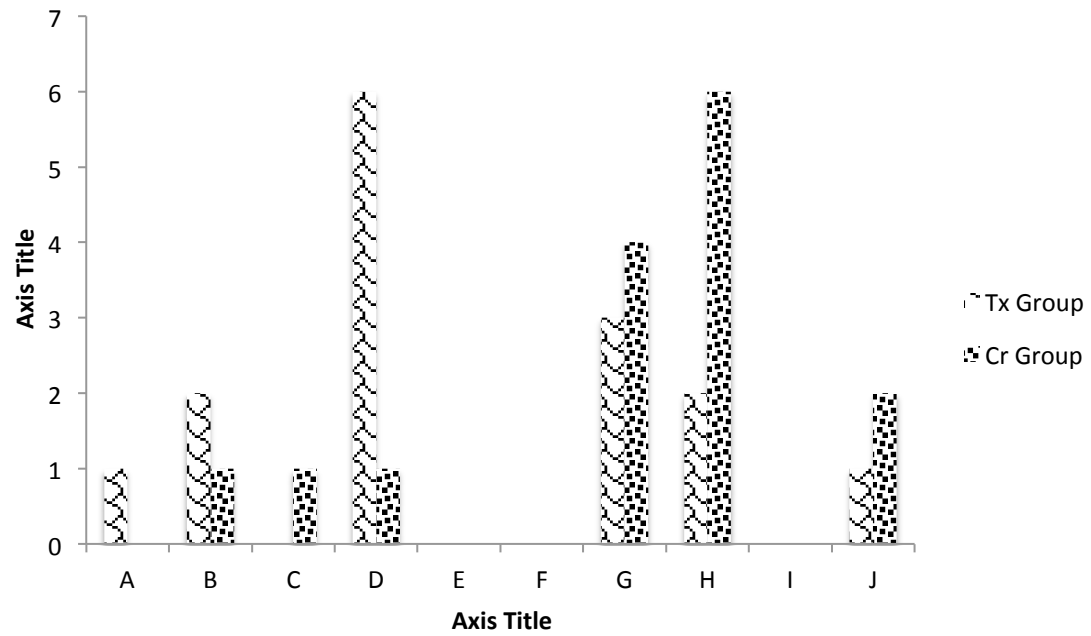


Figure 3. Cluster analyzed grid data for 02x.



*Figure 4.* Element-Ideal matches. Elements that matched highest with imagined ideals aggregated from individual cluster analyses for participants in the treatment and comparison groups.

Table 6

Highest Individual-Overall Construct Matches From Cluster Analyses

| ID  | Highest linking elicited construct with <i>overall</i> |
|-----|--|
| 01x | <i>(not recorded)</i>                                  |
| 02x | <i>immersion*—still</i>                                |
| 04x | <i>no water—water*</i>                                 |
| 05x | <i>ruggedness*—monotonous</i>                          |
| 06x | <i>not everyday*—familiar / everyday</i>               |
| 07x | <i>manicured—less contrived*</i>                       |
| 08x | <i>concentrated sunlight—dispersed sunlight*</i>       |
| 09x | <i>manicured—shaggy*</i>                               |
| 10x | <i>wild / natural*—busy with people</i>                |
| 11x | <i>limited time—unlimited time*</i>                    |
| 12x | <i>openness*—confined</i>                              |
| 13x | <i>naturally diverse*—less diverse</i>                 |
| 15x | <i>social—calm*</i>                                    |
| 16x | <i>rugged*—flat</i>                                    |
| 24x | <i>warmer / brighter*—colder</i>                       |

### 3.3.4 Summary

Individuals in the treatment group construed NREs in a relatively similar fashion overall, and none were considered to construe NREs in a way that was exceptionally different from that of their peers (i.e., neither lopsided nor too simple/complex). Among individuals in the treatment group, the Id was most often linked highest with a priori elements that depicted natural spaces lacking human manipulation. Moreover, constructs that were highly linked to the *overall* construct were those that construed NREs as remote and wild, yet were relatively calm, natural settings. Thus, despite being a group of individuals with unique personal histories and preferences, there were similarities in the ways in which an ideal NRE was constructed and how participants construed these elements. Consequently, the 15 grids in the treatment group were aggregated to permit broader group comparisons with those grids elicited from the comparison group.

## 3.4 Nomothetic Analyses

Aggregating the data from the 15 grids in the treatment group was completed using the SocioGrids “mode grid” function in Rep 5. The mode-grid was computed by setting the Minkowski metric = 1.0 (city-block distances) and a cut-off statistic = 80.00 (Gaines & Shaw, 2009b), which generated a mode grid with at least one construct from every individual in the treatment group. It contains the most highly matched constructs (by ratings) above the desired threshold (Shaw, 1980). Thus, the mode grid contained 63 constructs with participant contributions ranging from 1 construct (10x; 1.59%) to 8 constructs (13x; 12.7%). Interestingly, the one individual who contributed a single construct to the mode grid was the individual in the treatment group who had more difficulty with the interview than others due to her use of English as her second language.

### 3.4.1 Mode grid cluster analysis

The graphic output of the focused mode grid for the treatment group is displayed in Figure 5. Notably, three relatively distinct clusters of elements emerge: 1) Elements E-I-A, 2) B-J-F, and 3) D-H-G-Id, while Element C remains independent until approximately the 70% level of similarity. In the mode grid Element G was the most closely linked with the Id, linking at 86.2%.

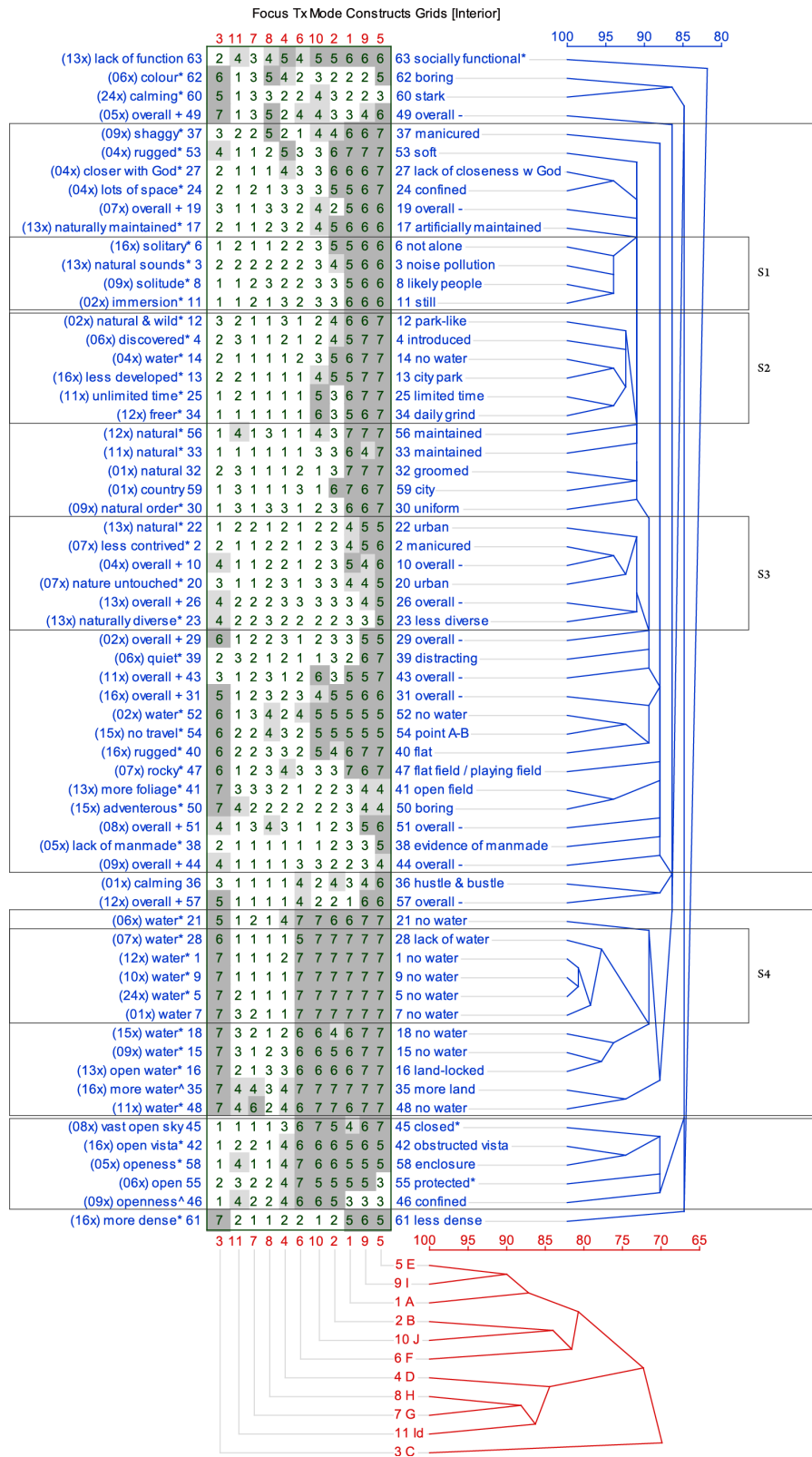


Figure 5. Cluster-analyzed mode grid from treatment group. This figure is accessible electronically in its full resolution as Supplement 1.

The Element D-H-G cluster, and the Id represented elements that contained only natural content and contained water.<sup>4</sup> Overall, the general pattern found was that elements clustered into one of three general groups: one which depicted urban or obviously influenced natural settings (E-I-A), natural spaces that are entirely natural but contained a path (B-F-J), and entirely natural spaces with water (D-G-H).

Next, construct clusters from the mode grid (Figure 5) were examined. A full resolution copy of Figure 5 is provided electronically as Supplement 1. The cluster analysis sorts constructs into groups based on their degree of similarity across ratings, where a higher linking percentage indicates a greater degree of similarity. Constructs in the mode grid clustered into a number of distinct groupings linked above 90.0% similarity<sup>5</sup>, which were then linked to approximately three larger clusters at around 86.0%, suggesting a relatively high degree of similarity overall. In order to more easily reference the clusters being described, the terms “primary” (P) and “secondary” (S) have been adopted. In this case, *primary* refers to the three larger and relatively distinct clusters, and *secondary* to sub-clusters containing four or more constructs within the primary clusters. Three primary clusters each formed at 87.9%, the largest of which (P1) contains 40 constructs (63%). While this cluster contains a relatively diverse range of constructs, they all generally refer to the relative “wildness” or “naturalness” of an element. As well, of the 10 *overall* constructs contained in the mode grid, eight are found within this first primary cluster. The second primary cluster (P2), which contains 11 constructs, is entirely composed of constructs with a reference to water. Finally, the third primary cluster (P3), containing 5 of the 63 total constructs (8%), relates to the relative placement and structural properties of trees and other large elements (e.g., geologic formations) in the setting, and whether they block the vista and/or create the sense of an enclosed and protected space.

The secondary structures offer a more nuanced perspective of the types of individual constructs that make up the primary clusters. For example, secondary clusters that are contained within the

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<sup>4</sup> It is important to note that the mode grid Id is conceptual, representing a “blended” Id based on the construct ratings for the Id from each individual’s grid.

<sup>5</sup> Output from the Focus algorithm in Rep 5 is rounded to the first decimal place.

first primary cluster, such as S1 and S2 offer a glimpse of not only what constructs are used in a similar way by different people, but also the language the participants use to describe them. For instance, S1 includes four constructs: two relating to the potential to be alone, one relating to the soundscape likely found within an element, and one relating to a feeling of becoming a part of a living thing. Similarly, S2 includes six highly interrelated constructs: two relating to “parks” and two similar constructs relating to a sense of “rush” and “somewhere to be” reminiscent of more urban settings, as well as two that relate more broadly to differentiating elements as being “introduced” or created and containing water—representative or more natural and wild spaces.

Despite there being relatively distinct secondary clusters, they are not easily interpreted as unique groups of constructs because of how quickly they join larger clusters. For example, the S1 cluster contains four constructs at 93.9% similarity, but then links with the six constructs from S2, as well as an additional 10 constructs at 90.9%. Thus, a 3% difference separates the four constructs found in S1 from the other 12 in this example. In fact, the entire mode grid and its 63 constructs links together at 81.8%—a relatively tight cluster in-and-of-itself. However, such high linkages are to be expected given that these constructs were derived from computing the mode grid, which itself is a product of the best matching constructs across all 15 grids in the treatment group. Further, while less may be gleaned from the secondary clusters on a nomothetic scale, the three primary clusters do reflect an interesting pattern in the mode grid. Specifically, the diversity of constructs contained within the first primary cluster, yet its relative size and importance compared to the other two primary clusters. Overall, constructs contained within this first cluster are indicative of the different ways in which “naturalness” can be construed across individuals in the treatment group. These relationships were further explored by computing a PrinGrid analysis of the treatment group mode grid.

### 3.4.2 Mode grid rotation

The PrinGrid analysis extracted eight components from the treatment group mode grid, three of which are of particular interest. Component 1 accounted for 64.41% of the variance, while Components 2 and 3 accounted for 13.18% and 10.79%, respectively (Table 7). In combination, these three components accounted for 88.38% of the total variance in the mode grid for the

Table 7

## PrinGrid Construct Loadings on First Four Components

| Item | Construct loadings on<br>each component |              |              |       | Mode grid construct                                  |
|------|---|--------------|--------------|-------|--|
|      | 1                                       | 2            | 3            | 4     |  |
| 1    | <b>-2.59</b>                            | <b>-1.62</b> | 0.18         | 0.01  | no water--water* (12x)                               |
| 2    | <b>-1.6</b>                             | 0.73         | 0.12         | -0.12 | manicured--less contrived* (07x)                     |
| 3    | <b>-1.64</b>                            | 0.58         | -0.22        | 0.02  | noise pollution--natural sounds* (13x)               |
| 4    | <b>2.08</b>                             | -0.98        | 0.16         | -0.51 | discovered*--introduced (06x)                        |
| 5    | <b>-2.56</b>                            | <b>-1.61</b> | 0.16         | 0.19  | no water--water* (24x)                               |
| 6    | <b>-1.94</b>                            | 0.48         | -0.65        | 0.16  | not alone--solitary* (16x)                           |
| 7    | <b>2.32</b>                             | <b>1.49</b>  | -0.11        | -0.34 | water--no water (01x)                                |
| 8    | <b>1.59</b>                             | -0.79        | 0.29         | 0.39  | solitude*--likely people (09x)                       |
| 9    | <b>-2.67</b>                            | <b>-1.68</b> | 0.23         | 0.02  | no water--water* (10x)                               |
| 10   | <b>1.55</b>                             | -0.49        | -0.64        | 0.04  | overall +--overall - (04x)                           |
| 11   | <b>1.84</b>                             | -0.71        | 0.5          | 0.08  | immersion*--still (02x)                              |
| 12   | <b>-2.07</b>                            | 0.86         | 0.1          | 0.35  | park-like--natural & wild* (02x)                     |
| 13   | <b>-2.37</b>                            | 0.54         | -0.27        | -0.04 | city park--less developed* (16x)                     |
| 14   | <b>-2.54</b>                            | 0.46         | -0.27        | 0.1   | no water--water* (04x)                               |
| 15   | <b>-1.97</b>                            | -0.93        | 0.44         | 0.23  | no water--water* (09x)                               |
| 16   | <b>2.01</b>                             | 0.96         | -0.47        | 0.05  | open water*--land-locked (13x)                       |
| 17   | <b>1.97</b>                             | -0.38        | 0.41         | 0.3   | naturally maintained*--artificially maintained (13x) |
| 18   | <b>-2</b>                               | -0.98        | 0.52         | 0.34  | no water--water* (15x)                               |
| 19   | <b>1.61</b>                             | -0.5         | -0.23        | 0.52  | overall +--overall - (07x)                           |
| 20   | <b>-1.22</b>                            | 0.38         | 0.25         | -0.3  | urban--nature untouched* (07x)                       |
| 21   | <b>2.14</b>                             | <b>1.22</b>  | 0.33         | 0.18  | water*--no water (06x)                               |
| 22   | <b>-1.27</b>                            | 0.82         | -0.23        | 0.13  | urban--natural* (13x)                                |
| 23   | 0.61                                    | -0.3         | -0.7         | 0.06  | naturally diverse*--less diverse (13x)               |
| 24   | <b>1.96</b>                             | -0.31        | 0.39         | -0.08 | lots of space*--confined (04x)                       |
| 25   | <b>-2.42</b>                            | 0.7          | -0.5         | -0.36 | limited time--unlimited time* (11x)                  |
| 26   | 0.82                                    | 0.07         | -0.35        | -0.05 | overall +--overall - (13x)                           |
| 27   | <b>2.15</b>                             | -0.32        | 0.57         | -0.13 | closer with God*--lack of closeness w God (04x)      |
| 28   | <b>-2.73</b>                            | <b>-1.17</b> | 0.11         | -0.19 | lack of water--water* (07x)                          |
| 29   | <b>1.09</b>                             | -0.23        | <b>-1.21</b> | -0.11 | overall +--overall - (02x)                           |
| 30   | <b>1.69</b>                             | <b>-1.41</b> | 0.32         | -0.07 | natural order*--uniform (09x)                        |
| 31   | <b>1.67</b>                             | 0.12         | -0.51        | 0.22  | overall +--overall - (16x)                           |
| 32   | <b>-2.28</b>                            | <b>1.04</b>  | -0.13        | 0.81  | groomed--natural (01x)                               |
| 33   | <b>-2.06</b>                            | 0.7          | -0.29        | -0.28 | maintained--natural* (11x)                           |
| 34   | <b>-2.31</b>                            | 0.38         | -0.46        | -0.82 | daily grind--freer* (12x)                            |
| 35   | <b>-1.45</b>                            | -0.94        | 0.05         | 0.16  | more land--more water^ (16x)                         |
| 36   | <b>1.52</b>                             | 0.32         | -0.09        | -0.29 | calming--hustle & bustle (01x)                       |
| 37   | <b>-1.61</b>                            | 0.99         | 0.25         | -0.68 | manicured--shaggy* (09x)                             |



| Item | Construct loadings on |              |              |          | Mode grid construct                          |
|------|-----------------------|--------------|--------------|----------|--|
|      | each component        |              |              |          |  |
| 38   | <b>1.18</b>           | -0.47        | -0.27        | -0.12    | lack of manmade*--evidence of manmade (05x)  |
| 39   | <b>1.43</b>           | -0.99        | -0.14        | -0.55    | quiet*--distracting (06x)                    |
| 40   | <b>1.88</b>           | -0.25        | -0.78        | 0.29     | rugged*--flat (16x)                          |
| 41   | 0.36                  | -0.24        | <b>-1.53</b> | -0.28    | more foliage*--open field (13x)              |
| 42   | <b>1.48</b>           | 0.69         | <b>1.4</b>   | 0.12     | open vista*--obstructed vista (16x)          |
| 43   | <b>1.77</b>           | -0.15        | -0.15        | <b>1</b> | overall +--overall - (11x)                   |
| 44   | 0.9                   | 0.57         | -0.52        | 0.02     | overall +--overall - (09x)                   |
| 45   | <b>2.01</b>           | 0.8          | <b>1.17</b>  | 0.6      | vast open sky--closed* (08x)                 |
| 46   | 0.14                  | 0.9          | <b>1.37</b>  | 0.13     | openness^--confined (09x)                    |
| 47   | <b>1.74</b>           | -0.36        | -0.89        | 0.04     | rocky*--flat field / playing field (07x)     |
| 48   | <b>1.23</b>           | 0.8          | -0.15        | -0.19    | water*--no water (11x)                       |
| 49   | 0.69                  | 0.41         | <b>-1.37</b> | 0.57     | overall +--overall - (05x)                   |
| 50   | 0.47                  | 0.05         | <b>-1.32</b> | -0.69    | adventerous*--boring (15x)                   |
| 51   | 0.83                  | <b>-1</b>    | -0.97        | 0.18     | overall +--overall - (08x)                   |
| 52   | <b>1.11</b>           | 0.57         | -0.67        | 0.49     | water*--no water (02x)                       |
| 53   | <b>-2.19</b>          | 0.37         | -0.04        | 0.17     | soft--rugged* (04x)                          |
| 54   | <b>-1.09</b>          | -0.1         | 0.72         | -0.48    | point A-B--no travel* (15x)                  |
| 55   | -0.68                 | -0.91        | <b>-1.13</b> | 0.21     | protected*--open (06x)                       |
| 56   | <b>2.04</b>           | <b>-1.22</b> | 0.48         | 0.1      | natural*--maintained (12x)                   |
| 57   | <b>1.49</b>           | 0.41         | -0.9         | -0.42    | overall +--overall - (12x)                   |
| 58   | <b>1.22</b>           | 0.87         | <b>1.62</b>  | -0.24    | openess*--enclosure (05x)                    |
| 59   | <b>-2.25</b>          | 0.7          | -0.74        | 0.88     | city--country (01x)                          |
| 60   | 0.11                  | 0.48         | -0.79        | 0.58     | calming*--stark (24x)                        |
| 61   | <b>1.56</b>           | -0.14        | <b>-1.39</b> | -0.85    | more dense*--less dense (16x)                |
| 62   | -0.04                 | -0.12        | <b>-1.34</b> | 0.73     | colour*--boring (06x)                        |
| 63   | -0.94                 | 0.49         | -0.78        | -0.2     | socially functional*--lack of function (13x) |

treatment group. Assuming an arbitrary cut-off of 1.0 for the construct loadings (see boldface type in Table 7), 51 of the 63 constructs (81%) loaded on the first component, 10 loaded on the second component, and 11 constructs loaded on the third. Of those 51 constructs that loaded on Component 1, nine loaded on the Component 2 also, in addition to a tenth construct that loaded solely on the second component. Five constructs from the 51 that loaded on the first component loaded on Component 3 also, in addition to 6 other constructs that loaded on the third component solely. Overall, of the 63 total constructs in the mode grid, 16 loaded above 1.0 on more than one component and 5 failed to load on any components extracted by the PrinGrid analysis (Table 7).

Considering the PVAFF (i.e., Component 1, 64.41%) of this extraction, a relative unidimensionality of the mode grid emerges where Component 1 captures constructs used to construe what a “natural space” is and how it differs from “non-natural” place. Among the constructs that loaded on Component 1, 6 of the 10 *overall* constructs and all 13 *water* constructs were included, indicating a relationship with the broader meaning of “naturalness” captured by Component 1. Next, 9 of the 10 constructs that loaded on Component 2 also load on Component 1; however, the loadings were greater (in absolute terms) for the first component than the second in every case. Of those constructs that did load on Component 2, 6 of those 10 constructs (60%) related to water. The fact that these constructs loaded on two components indicates that not only do they share a relationship with the other constructs subsumed by Component 1, but that they may also be represented by a second interpretation—in this case the presence or absence of water.

Next, constructs loading on Component 3 do appear to further contextualize Component 1—particularly relative to construing the structural properties within the elements. For example, 11 constructs load on Component 3, and of these, six (55%) do so only on this component, potentially indicating increased independence and meaning. That is, Component 3 might serve as an important dimension of meaning different from either naturalness or water. For instance, the constructs that load on Component 3 are differentiated from other constructs in the mode grid in that they generally refer to the overall structure or composition of the element (i.e., structural properties). To visually represent how the mode grid can be expressed relative to

*Figure 6.* PrinGrid spatial plot of first three components. This figure plots the 63 constructs and 11 elements from the treatment group mode grid in a three-dimensional space defined by Components 1, 2, and 3 (axes). This figure is accessible electronically in its full resolution as Supplement 2.

*Figure 7.* Reoriented spatial plot of first three components. This figure displays the same constructs, elements, and components as Figure 6, but the components have been reoriented along different axes to provide an additional perspective of how constructs relate to each of the three components. This figure is accessible electronically in its full resolution as Supplement 3.

these three components, as well as how the constructs and elements relate to each other, the graphic plot of the mode grid PrinGrid is presented in Figure 6. A full resolution copy of Figure 6 is provided electronically as Supplement 2.

While the PrinGrid output can appear somewhat chaotic due to the 63 constructs being fit into the component space, there are some particularly interesting details that can be gleaned from the plot. First, examining where the elements locate in this space reveals the relatively vast difference between Element C and the rest of the elements. For example, Element C is plotted in a space relatively void of both constructs and other elements, while two element clusters (D-G-H-Id and A-E-I) form along the opposing ends of the first component (naturalness). As well, these two clusters are accompanied by a number of construct poles in their respective spaces, while Elements B, F, and J are plotted relatively on their own.

A second plot (Figure 7) reorients the components along different axes to permit a second perspective of the mode grid data. A full resolution copy of Figure 7 is provided electronically as Supplement 3. Figure 7 more clearly displays the relative influence of Components 1 and 3 over Component 2. For example, while it was more difficult to discern in Figure 6, it is evident from Figure 7 that relatively fewer constructs are represented by Component 2 (as reflected by the angle between the line drawn for any given construct and the axis for that component; Jankowicz, 2004).

In summary, based on the cluster and PrinGrid analyses, which complement each other well, it is appropriate to infer that mode grid data obtained from the treatment group do reflect a general pattern of construing. This pattern seems to be primarily differentiated by the meaning captured by Components 1, 2, and 3—that is, naturalness, water, and structural properties, respectively. Finally, in order to determine if there were any unique differences in the constructions of NREs made by individuals treated for cancer, the data from the treatment group were compared with nomothetic data extracted from the comparison group.

### 3.4.3 Comparing groups

RepSocio was used to compute a “composite” grid for each of the treatment and comparison groups. These two composite grids aggregated the respective constructs and ratings from every grid from each group while the elements remained constant. As such, the composite grid for the treatment group contained 128 constructs and the composite grid for the comparison group contained 130 constructs. Consequently, each composite grid retained the raw grid data from each participant.

Before comparing the composite grids from the two groups it is important to note some general similarities and differences between the two. Measures of central tendency, as well as construct grand means and PVAFF scores for the comparison group are presented in Table 5. Notably, there appears to be little difference in either lopsidedness or PVAFF scores between the two groups as a whole. However, there is more variability in the data from the comparison group. For example, while the grand construct means are similar between the two groups, the range is broader in the comparison group. As well, the average PVAFF is relatively similar between the two groups; however, there is again more variability in the comparison group. For instance, the PVAFF score of 79.44 derived from one comparison individual’s grid reflects strong unidimensionality in her construing of NREs.

To compare the constructions of NREs between the treatment and comparison groups, each group’s composite grid was next compared using the “Compare” algorithm in Rep 5. This analysis was computed twice: the first specifically comparing the elements in each grid (Figure 8), the second comparing constructs (Supplement 4, electronic only). As such, Figure 8 displays each element from the treatment group alongside the best matching element from the comparison group. Similarly, Supplement 4 displays every construct from the treatment group with its corresponding best match from the comparison group. However, Supplement 4 also displays element similarity scores between the two groups. Both analyses were computed using the default Compare settings, which included city block distances (Minkowski metric = 1.0) and a cut-off score of 50 (Gaines & Shaw, 2009a).

Compare Tx Composite Constructs Grids correspondence from Cr Composite Constructs Grids [Match: 82.28]

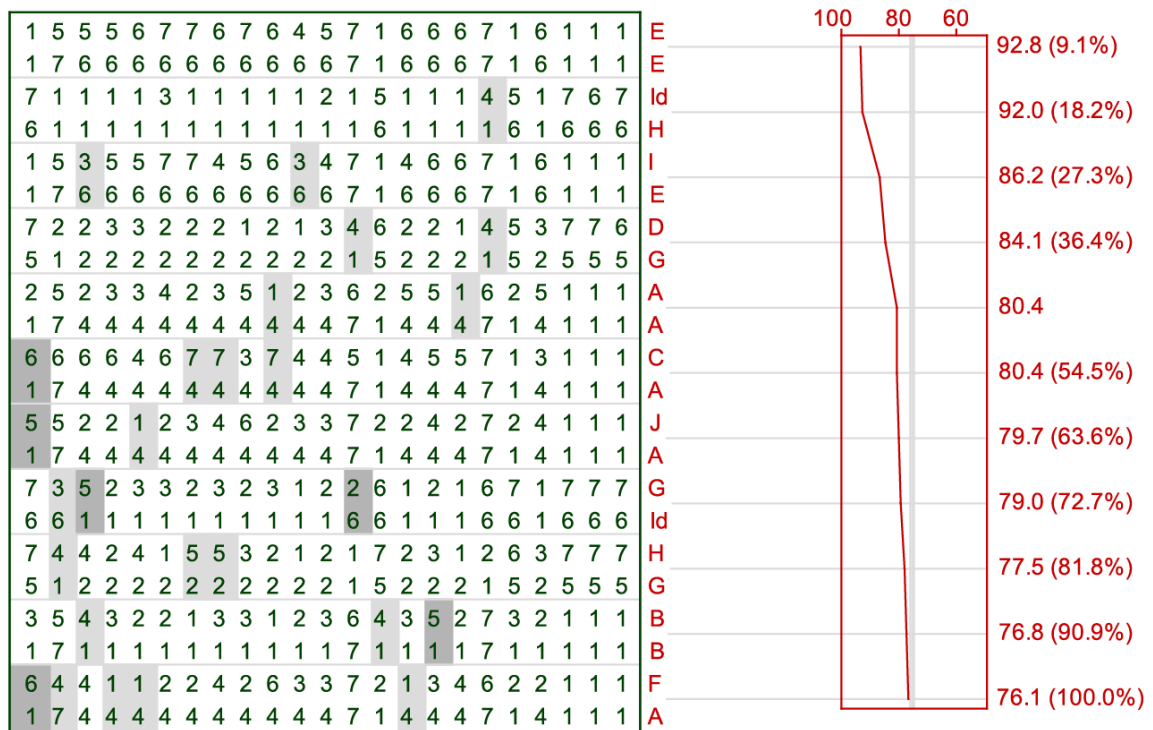


Figure 8. Cluster-analyzed elements. Highest matching elements from the treatment group (above pair line) and control group (below pair line) displayed as pairs.

First, the plot generated from the element matches comparison (Figure 8) displays how elements in the comparison grid were matched to elements in the treatment grid. Interestingly, the same elements from the two grids did not match in every case, occurring only for Elements E (92.8% similarity), A (80.4% similarity), and B (76.8% similarity). Element H was the best matching element from the comparison grid with the Id from the treatment grid (linked at 92%), meaning that these two respective elements were construed most similarly between the two groups.

Second, the construct comparison (Supplement4) generated an overall match of 88.88%, which is calculated based on both construct and element linkages. In total, 126 constructs (98%) linked above 80%, and all 128 treatment group constructs linked to a comparison group construct at or above 77.3%. Six individuals in each group had their *overall* constructs link together, accounting for 40% of each group's membership. Finally, element similarity scores, which measure the degree of similarity between each pair of identical elements from the two composite grids ranged from 85% (Id) to 91.3% (Element G). Ultimately, these similarity scores are indicative of the overall lack of meaningful difference between the treatment and comparison groups. That is to say that the two groups construed the same elements with a relatively high degree of similarity, overall.

### 3.5 Summary of Findings

Overall, ideal NREs and individual ways of construing NREs varied across all of the individuals in this study. Such variation is indeed anticipated according to constructive alternativism and PCP. However, similarities did emerge between the two groups. First, individuals in the treatment group were found not to construe NREs in meaningfully different ways from each other, regardless of the nature of their cancer diagnosis and treatment regime. Thus, their data were combined and analyzed in aggregate, which revealed patterns of construing that were predominately dominated by interpretations of naturalness, and further nuanced by interpretations of water and structure. When compared to how NREs were construed by the comparison group, no substantive differences emerged based on a comparison of their composite grids. Thus, there did not appear to be meaningful differences in how NREs were



construed between individuals in this study who were treated for cancer with chemotherapy compared with age- and gender-matched individuals never diagnosed with cancer. Therefore, these data do suggest that a shared preference for relatively wild and natural settings as NREs may exist among the participants in this study.

## Chapter 4

*I have found that moments of deeply felt kinship with one's nonhuman environment are to be counted among those moments when one has drunk deepest of the whole of life's meaning.*

Harold Searles

### 4 Discussion

The primary purpose of this investigation was to investigate how a group of 15 individuals diagnosed with and treated for cancer construed natural restorative environments (NREs). Second, this study sought to determine if these individuals construed NREs differently from a comparison group of 15 gender- and age-matched individuals who had never been diagnosed with cancer. These questions were intended to explore whether the toxicity and disability associated with chemotherapy for cancer treatment might influence a change in the way NREs are construed following cancer therapy. In the oncology literature, it is often reported that cancer survivors experience changes in the ways in which they perceive and value meaningful moments, relationships, and experiences in their lives (e.g., Deimling, Broman, & Wagner, 2007; Foley, Farmer, Petronis, Smith, McGraw, Smith et al., 2006; Rowland, 2008; Zebrack, 2000). For example, Foley et al. (2006) have described how some long-term cancer survivors reported improved relationships with friends and family following their cancer experience, while Zebrack (2000) has discussed how cancer survivors reconstruct self-identities and perceptions of meaning. Therefore, the rationale underlying this study evolved from a desire to explore whether such potential existential shifts in perception and meaning following chemotherapy might also manifest in the ways these individuals construed restorative properties of nature and the natural environment. If meaningful differences were found to emerge they would be considered relative to the theoretical assumptions in the RE literature, and the tenets espoused by Ulrich's psychoevolutionary framework (PEF; Ulrich, 1983) and Kaplan and Kaplan's attention

restoration theory (ART; 1989), in particular. The constructions of NREs were investigated in this study in the context of PCP and collected through a repertory grid analysis.

## 4.1 Application of the Repertory Grid Method

As a methodology, the repertory grid technique yields a vast amount of data, and there exist numerous ways in which these data can be analyzed depending on one's needs and intentions (Fransella et al., 2004; Jankowicz, 2004). In this study, the ways of construing NREs were investigated by exploring patterns and descriptive analyses of the grid data. Given that each grid and the constructs it contained represent individual perceptions, it was necessary to interpret the overall meaning of each construct carefully and purposefully (Fransella et al., 2004; Jankowicz, 2004; Kelly 1955). That is, each construct represented an interpreted and shared meaning communicated from each individual participant to the investigator in a way that permitted me to similarly construe the elements according to his/her constructs. In fact, every construct and the poles used to describe it had already been negotiated between each individual and myself as an exercise in the dynamics of Kelly's (1955) sociality corollary. Briefly, that corollary would suggest that in order to construe elements similarly, one must construe the construction processes of another. Therefore, to truly understand what was being communicated to me, it was necessary that I could similarly construe elements in a way that was congruent with the constructs being described to me by each participant. This process was achieved by engaging in in-depth discussion that focused on understanding the meaning intended behind the language one used to describe his/her constructs (Kelly, 1955). Consequently, because constructs are truly unique to each individual, it would be erroneous to claim that they mean the same thing or are otherwise *identical* across individuals, despite them being elicited relative to 10 identical elements. In fact, constructive alternativism would suggest that even constructs that are lexically close or identical cannot be blindly interpreted as equal in meaning or implication (Fransella et al., 2004; Jankowicz, 2004; Kelly 1955). Such constructs are not, however, incongruent, incompatible, or unrelated. Instead, each construct may be sorted according to inference and abstract meaning based on common factors, features, and meanings gleaned from the each grid and the interview that produced it (Kelly, 1955). Thus, when constructs are compared, contrasted, and described in aggregate within the discussion to follow, they are done so in a

generalized manner and in a manner so as to interpret similar value(s) and meaning(s) among them.

Overall, the 30 interviews generated 258 constructs across 11 elements, resulting in 2838 ratings and more than 40 hours of recorded interviews. In this investigation, a common *overall* construct, and one's imagined ideal NRE (Id, which represented each individual's "gold standard") served as cardinal points of reference for drawing inferences about how NREs were construed. These two indices are of primary importance in this investigation because they provided a foundation from which all other interpretations in this investigation are based. It is for this reason that the discussion that follows is primarily concerned with how the *overall* construct and Id element were related and construed as part of this investigation.

What follows next in this discussion is an analysis of how the ideal NRE was construed across the two participant groups, followed by a summary and elaboration of the results from the idiographic and nomothetic repertory grid analyses. Participant quotes have been added below to further contextualize the interpretation and discussion of the results from this investigation. Finally, this discussion will address the interpretation of the findings relative to the dominant theoretical frameworks in the RE literature, as well more broadly to consider the implications to oncology contexts. Recommendations for future research and a brief conclusion will complete this treatise.

## 4.2 Construing the Imagined Ideal

Individuals treated for cancer with chemotherapy in this investigation primarily construed NREs as natural places lacking human influence or manipulation, and almost always including a body of water. Moreover, ideal NREs were often open (but not exposed), afforded an expansive vista, and were generally remote and dominated by a natural order. While some people wished to be in their ideal NRE alone, others preferred some degree of social engagement, often wishing for the presence of a close family member or their dog. Overall, commonalities in what constituted an ideal NRE did emerge for those who were treated for cancer.

When compared to age- and gender-matched individuals who had never had a cancer diagnosis nor been treated for cancer, there appeared to be little difference between the two groups relative to how individuals construed their imagined ideal and its contents. What is more, the process of deconstructing each Id did not reveal substantive differences between individuals in either group based on age, gender, income, or education. Similarly, no substantive differences were found among Ids in the treatment group relative to one's site of diagnosis or the treatment(s) one received in addition to his/her chemotherapy (e.g., surgery and/or radiation therapy). Thus, despite the highly varied experiences one might have encountered relative to his/her diagnosis and treatment, there remained similarities in how ideal NREs were constructed among individuals treated for cancer and those individuals who had never been treated for cancer.

Finally, no obvious pattern emerged in or between groups based on whether one described him or herself as an "outdoors" type of person and/or what value one placed on his or her relationship with nature and the environment. In this context, both of these questions were intended to be interpreted openly by the participant, and were meant to reflect how connected one felt s/he was with nature and the natural environment.

In summary, and based on the data obtained as part of this investigation, individuals described their ideal NREs based on nuanced personal histories, preferences, and desires, rather than demographic-related information. For example, many of the Ids described were personally meaningful to participants. For instance, 01x identified the mountain that stood in front of her condo balcony as "my mountain," and that this condo was her escape, stating "I go there and I find peace ... when I can travel, that's where I go." Similarly, 11x described that her cancer diagnosis coincided with the beginning of a "spiritual journey," and that she defined restorative as "restorative to me, um, means natural ... and a place a person can go to heal ... the environment itself is restoring ... and we're able to restore ourselves." For 11x, her beach side Id at night reflected her desire for peace, a sense of unlimited time, and closeness with God. And finally, 22c reflected on her memories of home in Prince Edward Island and the limited time she gets to spend there now, describing "I always stand there before I leave ... and just try and take it all in."

Given the open, unstructured, and interpretive nature of the Id elicitation process inherent to the repertory grid method, such differences across individuals are expected. In fact, such differences are encouraged because they represent the broad scope of natural environments with the maximal likelihood for potential restoration. Furthermore, being able to identify and account for individual differences in preference are important because unique differences between individuals reflect one's own personal history and how constructive alternativism describes that elements can be construed in an infinite number of ways (Kelly, 1955). Therefore, while an individual grid analysis (e.g., as in psychotherapy) may focus precisely on individual differences in one's grid, grid analyses based on groups may look for the fundamental similarities that exist *across* individuals. Indeed, while each individual in this study described a unique Id that was personally meaningful, basic content and qualities necessary to create a NRE were generally similar across the 30 individuals in this study. In the majority of the cases described herein, it was as if individuals were describing different places, spots, or views, within a broader, common setting, such as a provincial or national park—each individual having their own favourite spot to visit.

#### 4.2.1 Immersion and Companionship

To help organize the ways in which individuals constructed their ideal NRE, two general categories, namely “immersion” and “companionship,” were created to sort the 30 Ids (see Figure 2). Relative to immersion, the term “surrounded” was used to differentiate Ids that were described by participants as places where the natural elements were close and enveloping as distinguished from those Ids that were described as places that existed almost *between* two primary components of the setting (i.e., termed “on the margin”). For example, a small opening in a forest would be labeled surrounded, while a sandy beach between the tree line and a large body of open water would be labeled as on the margin. Similarly, companionship was used to sort Ids based on whether one described places that contained a social component (labeled “social”) or if one described their Id as being a solitary place (labeled “solitary”). For instance, a tourist location would be labeled as social, while an isolated hiking trail would be labeled solitary. In the majority of cases, participants from both groups described their Ids as surrounded and solitary natural environments (Figure 2).

To plot Ids relative to immersion, an Id was considered to be on the margin if it was described as being predominately open with a large vista, separated from the tree line, and provided a sense that the natural content was not enveloping, or “close enough to touch.” In contrast, an Id was labeled as surrounded if it was described as being enclosed within the natural content (most often by vegetation) and/or by landforms of that space, such as rocky cliffs. In a way, the degree of immersion was interpreted relative to how many “sides” (e.g., sight lines) were open or closed to the surrounding environment as described by the participant. For example, Ids that were described as being on expansive beaches were usually open on at least three sides, meaning that one had unobstructed sight lines in front and to each side. In some cases, individuals also specifically described being separated from any vegetation behind them (usually trees), meaning that the Id was nearly open on all four sides. Thus, Ids that were described as being open on three or four sides were sorted as on the margin.

On the other hand, other participants described their Id as a place that was surrounded—usually by a forest—on at least three sides, often with the fourth side being a vista that emerged from a trail or the shore of a small forest-lined lake. As such, Ids described as being enveloped by natural content were sorted as surrounded. Moreover, some Ids were not explicitly described as either surrounded or on the margin. In these cases, one’s description of his/her Id reflected some characteristics that were surrounded and some that were on the margin. Forcing these types of Ids into one of the two existing categories would have stripped an Id of its uniquely restorative characteristics as defined by the individual. Therefore, an Id was labeled “mixed” if one’s description of his/her Id somehow captured both ends of the continuum. For instance, an Id that was described as being in a canoe in the middle of a small northern lake surrounded by forest and rock faces (04x), and one another described as a tropical tree-lined beach with the mountains close and off to one side (06x) were both categorized as mixed on the immersion continuum.

Relative to companionship, an Id was considered social if it was described as being a predominately built place that included natural content, but also social activity or the high

likelihood of encountering others, such as tourists.<sup>6</sup> Conversely, an Id was considered solitary if the individual described being completely on his or her own within that space. Of note, the term “companionship” was used because some individuals described being in their Id with their dog, thus, conveying a sense of being in that space with a loved one (i.e., companion), yet not being either totally alone or surrounded by other people. As was done for immersion, Ids were also plotted as mixed if one described a grey area between a social place and a solitary place. For example, one participant’s desire to be in the woods walking his dog (29c) was categorized as mixed.

One’s desire to be in an NRE with his/her dog is interesting because this preference reflects not only a desire to be with a loved one, but also because this loved one is an animal and, therefore, an arguably more direct extension of nature than another human. Indeed, there is an emerging evidence base related to pet- and animal-facilitated health outcomes (e.g., Brodie & Biley, 1999; Jorgenson, 2007; Wells, 2009), and our relationship with animals relative to the biophilia hypothesis (Wilson, 1984, 1993) has been explored previously (see Katcher & Wilkins, 1993; Lawrence, 1993; Shepard, 1993, for example). While this investigation did not explicitly intend to seek information relative to animal companionship in NREs, it is nonetheless interesting that this theme did emerge, even if only in a small number of instances. Regardless, the potential that animals might constitute an important element of the restorative experience for some individuals is worthy of future exploration.

Plotting Ids according to immersion and companionship was specific to this investigation and emerged from my interpretation of one’s description of his/her Id during the interview. This exercise served to group the Ids meaningfully, despite the high variability among them. The relative disproportionality of Ids described as places that are predominately composed of natural content and in which one preferred to be alone is, perhaps, not surprising given the purpose of describing a preferred restorative space. That is, it is possible that individuals were predisposed

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<sup>6</sup> Recall that individuals could describe *any* type of place as their Id, provided it included some degree of natural content.



to describe a relatively natural space (rather than a built one) because they were aware that the focus of the investigation revolved around human relationships with nature. However, the instructions to describe their ideal NRE explicitly stated that it could be *any* place that included even a small degree of natural content, ranging from the middle of the woods to a backyard garden or even a busy city park. As such, participants were able to discuss any type of setting they pleased, provided they would find it an ideal setting to promote restoration for them. As well, individuals described their NREs before viewing the a priori elements. Therefore, it is reasonable to infer that regardless of context, these individuals would describe similar ideal NREs. This is due to the fact that not only were these places construed as maximally restorative for that individual, but also because most Ids were meaningful in some way to each participant, reflecting their favourite natural places or reminding them of such places. Thus, in addition to being maximally restorative for each participant, there is likely a personal connection to each person's Id that prompted its description.

#### 4.2.2 Water

In his original development of PEF, Ulrich (1983) discussed the increased restorative potential derived from a NRE containing water; a theme that was clearly reflected in this investigation. For instance, 26 of the 30 Ids elicited from participants included water (87%), and 22 of the grids (73.33 %, 11 in each group) linked Ids highest with a priori elements containing water in the cluster analyses (Elements D, G, and H). Moreover, the PrinGrid analysis of the treatment group mode grid revealed that those constructs that loaded on Component 2 were heavily represented by constructs relating to water. Indeed, water was a salient theme that occurred often in the interviews as being fundamentally important to some participants' Ids. For example, 04x described that "water has, I think, always been really important in my life" and "there's just something about being in that canoe that just slows things down." In a similar vein, 02x described the sound of the water when sailing, noting her adoration for "the rushing, gurgling sounds as the boat makes way in the water," and 24x stated "I like to see it; it's very soothing, relaxing, and I like the sound."

Although Ids were found to link with Element D more often in the treatment group and Element H more often in the comparison group (Figure 3), there was little evidence from the interviews or the grids that explained this difference. While, it might be tempting to seek differences between the content of Elements D and H relative to environmental interpretations of idyllic versus exposed, warm versus cold, or lush versus bare, etc., respectively, there was little to be gleaned from the interviews that would support such characterizations.

Furthermore, the mean *overall* ratings for Elements D and H among those individuals in the treatment group whose Id linked highest with D ( $n = 5$ , one overall construct missing) were 1.60 and 3.2,<sup>7</sup> respectively. Comparatively, the mean *overall* ratings for Elements D and H among those individuals whose Id linked highest with H in the comparison group were 3.5 and 1.83, respectively ( $n=6$ ). Therefore, despite D being preferred over H by these individuals in the treatment group, H was still construed as a restorative place, relatively speaking. Similarly, although Element H was preferred most often in the comparison group, D was still construed as restorative by these individuals. Thus, although Elements D and H displayed different natural settings, they were both construed as being restorative overall, albeit to different degrees. Based on the descriptions of ideal NREs, as well as the increased preference for Elements D and H, it is clear that water is important to the restorative experience.

### 4.2.3 Summary

Overall, the ideal NRE can vary widely across individuals. This is not surprising, perhaps, given the request for participants to describe their own personal ideal NRE. More importantly, however, is the finding from this investigation that despite varying individual preferences for an *ideal* NRE, there remains a range of natural environments that are construed as restorative places. This finding underscores the relative importance of common environmental features and content that can be construed as restorative across a group of people, rather than the degree to which imagined ideals themselves are similar across individuals. The primary importance of such

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<sup>7</sup> Recall that ratings were provided using a seven-point scale. Relative to the overall construct, 1 aligned with *overall restorative*, while 7 aligned with *overall not restorative*.

shared construing is grounded in the broad-scale decisions that impact how shared community spaces (e.g., urban green space, parks, conservations areas, or hospitals, etc.) must relate in common ways to the greatest number of people. While not every natural space will appeal in the same ways to all individuals, it is important that design and planning decisions reflect the maximal potential for restoration for the maximal number of people. Such decisions might be most pertinent in the context of shared spaces where individuals have the greatest potential to benefit from the restorative potential of NREs, such as hospitals and healthcare settings. For example, given the biopsychosocial impacts of disease and treatment (Engel, 1977, 1997), restorative experiences afforded by natural window views, gardens, and interior design in healthcare facilities may offer unique opportunities for respite, restoration, and improved health and well-being for individuals treated in those settings.

### 4.3 Construing Natural Restorative Environments

Across the 30 individuals evaluated in this study, patterns emerged relative to which elements were construed similarly and the constructs that were used to construe these elements. For example, similar numbers of constructs were elicited from each participant; the majority of elements were similarly construed as either being restorative or not restorative, and dominating themes (e.g., naturalness) within grids were common across individuals. Those patterns will be discussed in the sections to follow.

#### 4.3.1 Lopsidedness and Differentiation

As part of the initial individual grid analyses, two structural indices were computed to determine if any of the individuals in this study construed NREs in a fundamentally different way than that of their peers. These analyses included analyzing construct grand means as an indication of lopsidedness and the PVAFF as a measure of differentiation. These metrics reflected strategies recommend by Fransella et al. (2004) in their “pre-digestion stage” to orient one’s self with a participant’s grid data (pp.155-161). Consequently, potentially dramatic differences in one participant’s grid could be identified and compared to that of his or her peers before being aggregated. Lopsidedness was calculated to determine whether any grids were substantially “one-sided” compared to other individuals’ grids. That is, whether any individuals tended to

construe elements by relying on one pole of a construct substantially more than the opposing pole (Fransella et al., 2004). Grids with construct grand means that fell in the region of  $\leq 2$  or  $\geq 5$  would have been investigated further because they would reflect element ratings that highly favoured one construct pole. Overall, however, no construct grand means were considered to be lopsided based on these ranges and, therefore, no individuals were determined to have produced lopsided grids. Consequently, no grids in either group were identified as not being candidates for aggregation based on lopsidedness.

In addition to considerations of lopsidedness, the PVAFF statistic was calculated for each individual as an indication of construct framework differentiation (Baldauf et al., 2010; Hardison & Neimeyer, 2012). As a measure of differentiation (sometimes also referred to as complexity), the PVAFF provides an overall indication of relative importance of the first component (i.e., dimension of meaning) in one's construct framework (Hardison & Neimeyer, 2012).

Accordingly, higher PVAFF values are indicative of a relatively unidimensional construct framework, meaning that one dimension of meaning is primarily responsible for how elements in a given range of convenience are construed. On the other hand, lower PVAFF values indicate more multidimensionality in one's construct framework, meaning that more than one component significantly factors into how one construes a given set of elements. Simply put, a more unidimensional construct framework reflects more simple patterns of construing where an element is often construed as either *this* or *that*, while a more multidimensional construct framework reflects more complex patterns of construing in which multiple considerations are necessary. The meaning attributed to differentiation is embedded within the purpose of the grid and range of convenience being construed, meaning that neither too simple a grid nor too complex a grid are problematic in and of themselves.

While the mean PVAFF values (Table 5) in the treatment group and comparison group were similar (53.16% and 56.89%, respectively) there was relatively more variability in the scores from the comparison group (standard deviations of 6.56 and 10.12, respectively). Ultimately, however, the range of PVAFF statistics was not considered problematic or an indication that individual-level data within each group could not be aggregated. For example, while one individual in the comparison group (17c) had a PVAFF value that was 12% higher than the next

closest individual in either group, the implication of this difference, while interesting, is not worrisome in and of itself. For instance, 17c's PVAFF (79.44%) indicates that she construed these NREs in a relatively unidimensional manner, perhaps dominated by construing relative to naturalness and represented by her construct *manicured—natural\**. By comparison, the lowest PVAFF statistic in either group (43.71%) reflects that individual 08x relied on more independent dimensions of meaning to construe NREs. In her case, it may be that the constructs *remote\**—*populated*, *protected\**—*too exposed*, and *water—no water\** each factored importantly in how she construed a NRE. Indeed, each of 17c and 08x construed NREs quite differently and in ways that were uniquely meaningful to them. However, the average difference in *overall* ratings between these two individuals across the 10 a priori elements was 1.1 (SD = .74, range 0-2). Therefore, despite each of these individuals' highly individualized patterns in construing, there was very little difference in how NREs were rated according to the overall potential for restoration. Thus, this example highlights the truly individual ways in which individuals can construe identical elements, as well as how important it is to consider Kelly's constructive alternativism (1955) when interpreting repertory grid data. As such, identifying the most salient characteristics across individuals that predict the potential for a NRE to be construed as truly restorative becomes paramount. In this investigation, naturalness may be that most salient characteristic identified.

### 4.3.2 Naturalness

Perhaps the most salient commonality among the current participants was that elements were overwhelmingly differentiated by constructs relating to the degree of naturalness or human influence present in the scene. For example, approximately 25% of the constructs elicited from participants construed elements based on "naturalness" (57 of the 229 elicited, excluding the 29 *overall* constructs). In the majority of cases, elements depicting predominately natural spaces (i.e., those without human influence) were preferred and representative of an ideal NRE. Moreover, those elements that were most preferred and considered to be restorative were associated with feelings of peace and calm, and without a sense of urgency or purpose. Instead, they conveyed a sense of "natural order" or "nature untouched." For example, 23c discussed the "intimacy" and "engagement" she perceived when construing elements that were more natural

and surrounding, and 02x stated “I feel like I’m surrounded by something other than myself” and the pleasure that she derived from that feeling. Overwhelmingly, participants in this study construed those elements that were wild, natural, containing water, and removed from the city as characterizing the most restorative.

The salience of construing elements in this study according to naturalness echoes previous empirical work in the human-nature literature. For example, Chipeniuk (1995) similarly employed the repertory grid technique in an investigation that explored whether interpretations of “landscape naturalness” were culturally embedded (i.e., based in language and social norms or worldviews). To accomplish this, Chipeniuk conducted repertory grid interviews with three distinct cultural groups in Canada: Euro-Canadian individuals from Ontario, Vuntut Gwich’in Aboriginal peoples from Old Crow in the Yukon, and Inuit Aboriginal peoples from Clyde River, Northwest Territories. Chipeniuk’s purpose was to “test” whether construing various natural and human-manipulated settings relative to naturalness was culturally dependent. Chipeniuk reported that the primary factors in each group differed in interpretation based on the language used to describe them (e.g., “pastoral” for the Euro-Canadian group, either “natural” or “Gwich’in” for the Gwich’in group, and “Inuit” for the Inuit group). However, regardless of the translation of the primary factor, a common core factor, which he termed “natural” and represented by the construct *natural—man made*, was fundamental to the overall meaning of each of the three primary factors.

In his discussion, Chipeniuk (1995) reported that the essence of construing elements as *natural—man made* was shared across the three cultural groups and nested within each primary factor. He noted that this distinction was present after deconstructing the culture and language of the participants. For example, Chipeniuk noted that both the Inuktitut and Gwich’in languages lack a word equivalent to “natural” in English. Instead, the people in these cultures (and their language) do not view themselves as separate and distinct from nature and the land, but rather existing in harmony with the land. However, despite their worldviews, Chipeniuk described that *natural—man made* distinctions were still reflected in the grids of the Inuktitut and Gwich’in people, albeit differently from the grids collected from the Euro-Canadians. Thus, the nested, core factor relating to naturalness was determined to support the hypothesis that

detecting and interpreting naturalness was likely *pan-human*, rather than being culturally embedded (Chipeniuk, 1995). The salience of naturalness among constructs, as well as in how NREs were construed in this investigation is congruent with—though not fully supportive of—Chipeniuk’s (1995) conclusions.

In a similar study that also used a repertory grid approach, Home et al. (2010) sought to explore whether urban green spaces were evaluated based on culturally or biologically embedded determinants (i.e., constructs). In their investigation, Home and colleagues reported an overall inconsistency among participants relative to whether elements were construed according to either biologically- or culturally-based constructs. Moreover, elements that aligned best with an imagined ideal (interpreted as an indication of preference) varied across participants. Home et al. noted that because the elements depicted green spaces with varying degrees of wild nature, though they existed within a city, it could be expected that constructs fell along a continuum of biological–cultural, rather than being strictly biological or cultural. These authors related their findings to Bourassa’s (1990) paradigm for landscape aesthetics, which describes landscape preference relative to three origins: cultural, biological, and individual experience.

Bourassa’s (1990) tripartite paradigm suggests that instead of being either totally biological or totally cultural, landscape aesthetics might first be determined relative to the “origin” of the landscape in question. For example, according to Bourassa’s paradigm, natural landscapes might be primarily experienced and interpreted (i.e., construed) according to biological processes, whereas urban or built landscapes might be primarily construed relative to cultural processes. Further, the third mode in Bourassa’s (1990) paradigm accounts for individualized experiences that influence landscape aesthetics over time, meaning that personal histories and experiences must also be factored into interpreting landscape aesthetics. As a result, Home et al. (2010) discussed that the discrepant evaluations of urban green spaces might reflect Bourassa’s (1990) paradigm, noting that the predominately built elements were construed more culturally, while the more wild and natural elements were construed more biologically. Constructs in the present investigation were not examined for their biological or cultural origin, per say; however, there are constructs that clearly reflect culturally-based interpretations (e.g., [12x]*daily grind—freer\** and [15x]*point A-B—no travel\**) and biologically-based interpretations (e.g., [16x]*more*

*dense\**—*less dense* and [28c] *lush\**—*barren*). Thus, the data from this investigation would support Home et al.'s (2010) results that biological or culturally based constructs are likely to emerge from construing environments with varying degrees of wild naturalness and/or human influence and creation.

However, given that participants were asked to identify ways in which elements were similar and/or different, and that these elements varied from built to natural, it is not surprising (and in fact anticipated) that constructs would reflect both cultural and biological interpretations. What is more, the very nature of the repertory grid technique does, in a way, prompt certain constructs to emerge. For example, it was anticipated that the presence or absence of water would emerge in most grids, just as it might be expected that constructs relating to “speed” or “safety” would emerge from grids related to cars, or “sweet” or “sour” from construals of candy. Instead, it is the meaning attributed to naturalness, the element ratings based on naturalness, the dominance of naturalness in the Ids generated, and the relation of naturalness to the potential for restoration that are important to consider in the present investigation.

One possible interpretation of this result could be that naturalness, or a construct similar in meaning, may serve as a *superordinate* construct in the construct frameworks of individuals in this study. In PCP, a superordinate construct assumes a degree of dominance in one's construct framework, meaning that it would subsume other constructs in a hierarchy of meaning (Kelly, 1955). On the other hand, *subordinate* constructs provide more nuanced interpretations and serve to contextualize how one construes a given element within a broader universe of meaning. To illustrate this principle of ordinacy, the cluster-analyzed grid from participant 13x will be examined further (Figure 9).

Ratings in this participant's grid were made according to nine constructs (eight elicited plus the *overall* construct). The cluster analysis of the grid reveals that eight of these constructs cluster above 80.0, while the ninth is added to the cluster at 75.8. Of the nine constructs, four of them appear to relate directly to construing naturalness: *naturally diverse\**—*less diverse*, *natural\**—*urban*, *natural sounds\**—*noise pollution*, and *naturally maintained\**—*artificially maintained*. Moreover, these four constructs are joined by *more foliage\**—*open field*, creating a larger, six-



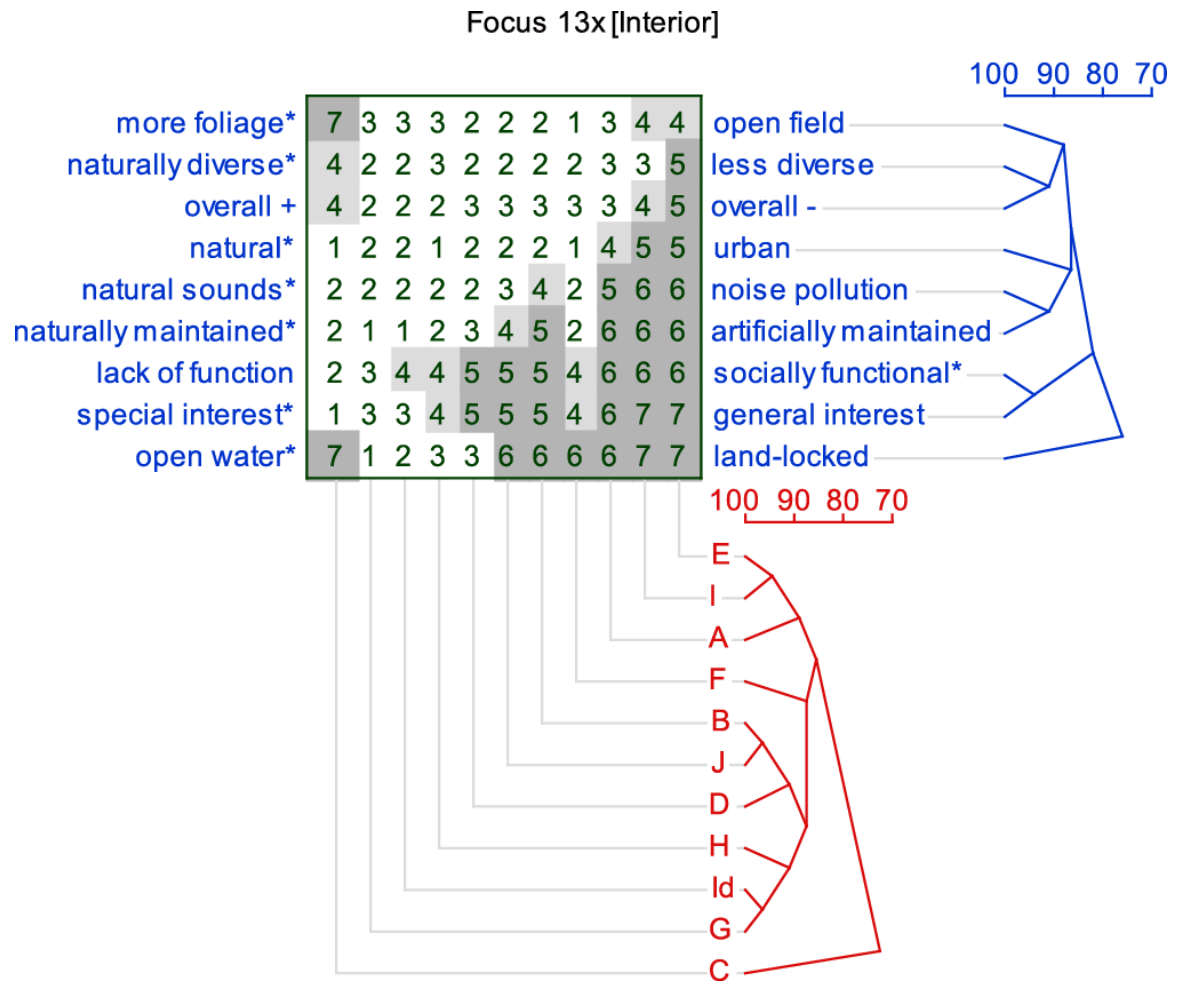


Figure 9. Cluster-analyzed grid for participant 13x.

construct cluster including the *overall* construct. Among these five elicited constructs, each appears to reflect incremental judgments that serve to contextualize, in greater detail, degrees of naturalness. Such would be the nature of subordinate constructs. As a matter of example, 13x's grid displays how, within a range of convenience defined by NREs, "naturalness," which might be defined by *naturally maintained*—*artificially maintained*, is further informed by constructs defining diversity of the vegetation, location, and soundscape. Consequently, *naturally maintained*\*—*artificially maintained* may be a superordinate construct for this individual, while the remaining constructs are subordinate, therefore, providing more contextualized judgments, interpretations, and predictions relative to what this participant construes a NRE to be.

It is important to note, however, that discussing construct *ordinacy* must be done with caution and interpreted within the context in which the grid data are collected. For example, Fransella et al., (2004) state that "Superordinacy is a relative term. A construct is seen as being more or less superordinate more or less of the time" (p.126). That is, superordinacy in a construct system is dynamic, meaning that the ordinacy of constructs is susceptible to change as every new event is construed. Thus, through experiencing new elements, constructs are revised and refined, and their relative ordinacy redistributed based on the outcomes of each experience.

Overall, however, construct ordinacy is usually investigated via methods not employed in this investigation, such as Hinke's (1965) implication grid technique and/or eliciting constructs through "laddering" (see for example, Fransella et al., 2004; Jankowicz, 2004). Moreover, while construct ordinacy can be useful for interpreting individual grids, the practice is less applicable to nomothetic data because individual-levels of meaning and idiosyncrasies in construing are suppressed when data are aggregated. Therefore, it would be inappropriate to make concrete claims relative to construct ordinacy based on the current data set. Nevertheless, discussing naturalness as potentially superordinate in constructions of NREs is important to consider given its potential cross-cultural implications, role in aesthetics, and it's potential to promote psychophysiological restoration, as well as to promote health and well-being. Among participants in this investigation, it is clear that construing NREs according to interpretations of naturalness was overwhelmingly represented by the constructs they described. Moreover, naturalness was fundamental to their descriptions of ideal NREs, and the relationships between

preference and restoration. As such, construing NREs according to naturalness was ultimately a primary factor that predicted the potential for restoration among individuals in this study.

### 4.3.3 Experience and the change corollary

The main objective of the present investigation was to explore whether the experience of being treated for cancer with chemotherapy influenced individuals to construe NREs differently from others never treated for cancer. Based on the results of this investigation, differences in how individuals construed NREs did not emerge from their experiences of cancer and chemotherapy. Instead, there was little difference overall relative to how NREs were identified and construed across the two groups. In fact, differences that did emerge were more reflective of the individuals in this study and their unique personal histories, rather than being relatable to their cancer experience (or lack thereof). Therefore, it could be concluded that the experience of chemotherapy did not meaningfully affect how individuals in this study construe NREs. By extension, because construing NREs relative to naturalness was common across individuals, it could be that “naturalness” as a construct is relatively stable and robust within the context of NREs. Similarly, it also may be possible that shifts in existential patterns of meaning attributed to cancer and its treatment that are reflected in interpersonal relationships do not manifest in judgments about the potential restorativeness of natural environments. For example, Kelly’s (1955) change corollary would suggest that personal constructs (e.g., honesty, beauty, naturalness, etc.) are reinforced or revised over time and based on personal experience. Congruent with the change corollary, changes in the meaning and importance of personal relationships and life events are commonly reported in the oncology literature (e.g., Foley et al., 2006; Rowland, 2008; Zebrack, 2000, among others). Indeed, when discussing her experience of treatment, 01x described that “normal will never happen ... and you do, you change your perspective.” In this way, it is possible that similar shifts in existential concerns related to the meaning of one’s relationship with nature and the environment could occur following chemotherapy.

For example, one individual in this study (06x) described a fundamental shift in her construction of an ideal NRE that was directly related to her cancer diagnosis. In her interview,

06x described that she spent significant amounts of time in the sun as a child and young adult, and that a bright and sunny tropical beach would have defined her ideal NRE before being diagnosed with cancer. However, her diagnosis of melanoma (i.e., skin cancer), meant that she was now forced to avoid the sun whenever possible as a matter of her health. In fact, during her interview she described her sun-avoidance strategies, which included high UV protection sunscreens, full-length sun protective clothing, and a parasol. This need for full sun protection was reflected in her ideal NRE, which she still described as a tropical beach, but with trees that could shelter her from the sun. In this way, while the sun was once restorative, it was now anything but, and was associated with fear and anxiety. In fact, when reflecting on meditation strategies that almost always suggest thinking about one's self in a warm and sunny place, 06x described that she cannot visualize and mediate on those types of places anymore because it stresses her out, stating "I don't know how to do that anymore." While this particular participant still preferred a sunny day to one that was overcast, her connection to the environment and the sun had changed. Thus, the restorative potential of a natural setting was related to her ability to be sheltered from the sun, not exposed to it. Interestingly, this woman was the only participant who was diagnosed with a skin cancer, and was also the only individual who explicitly acknowledged that her ideal NRE was different after cancer than before. However, given that a cancer diagnosis can occur in or on nearly any anatomical site of the body, and further the myriad environmental etiologies of some cancers, it follows that such shifts in construing could be more likely in sub-populations of individuals treated for cancer.

Furthermore, shifts in construing one's relationship with nature and the natural environment might similarly emerge in the ways in which one "connects" with nature. In fact, nature "connectedness" and "relatedness" have emerged recently as important considerations in the RE literature (e.g., Mayer & Frantz, 2004; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009; Zelenski & Nisbet, 2012). For example, Mayer and colleagues (2009) have identified nature connectedness as a potential mediator in outcomes predicted by experiences with REs. That is, being "connected" with the natural environment may facilitate restorative experiences. Moreover, the recently developed connectedness to nature scale (CNS; Mayer & Frantz, 2004) intends to measure "...one's experiential, emotional connection to nature ..." (p.505). Thus, its

items reflect broader existential meanings relative to one's relationship with the natural environment. Given the importance of emotion and meaning inherent to connectedness, it is conceivable that cancer and chemotherapy could influence how one construes his or her relationship with nature. Connectedness was not measured in the present investigation, however. That being said, it is also possible that nature connectedness (or NREs, for that matter) is not salient in the psychological processes that re-align constructs that are reported in individuals treated for cancer (c.f., Zebrack, 2000). Arguably, however, exploring connectedness in future nature-related studies that involve individuals treated for cancer could be important given the potential for connectedness to mediate positive outcomes related to NREs (Mayer et al., 2009). As such, it is possible that nature connectedness may also mediate broader positive influences on health, well-being, and quality of life.

In summary, and relative to how participants construed NREs in this study, there were few meaningful differences between individuals who had been treated for cancer with chemotherapy when compared to each other, or their gender- and age-matched counterparts. Overall, natural spaces were overwhelmingly preferred compared to settings that were primarily built or contained evidence of human influence. Not only was a high degree of naturalness preferred in one's NRE, but also construing NREs relative to naturalness dominated the ways in which elements in this study were construed and preferred. Moreover, individuals generally preferred spending time alone in a natural environment for the purposes of restoration. Finally, the disease- and treatment-related experiences that confront individuals who are treated for cancer do not appear to influence the ways in which these individuals construe the restorative potential of a NRE.

#### 4.4 Implications to PEF, ART, and the RE Literature

The RE literature is predominately influenced by two theoretical frameworks: Ulrich's psychoevolutionary framework (PEF; Ulrich, 1983) and Kaplan and Kaplan's attention restoration theory (ART; Kaplan & Kaplan, 1989). Although each framework predicts outcomes based on presumably independent pathways (psychophysiological and cognitively mediated, respectively), the respective stimuli described by PEF and ART as promoting

restoration are similar, if not the same in most cases. The research process described in the present investigation relied on a representative sample of natural settings that reflect the scope of environmental content described by PEF and ART in the elicitation of appraisals of their restorative potential. The goal of this process, therefore, was to identify within the context of PCP those features of these settings that promote a restorative experience and, further, to explore whether these judgments might differ across the two groups studied. While both PEF and ART describe the same relative stimuli and likely serve as complementary frameworks (Hartig et al., 2003), one could argue that the essence of the components that describe an RE are different in each framework.

For example, Ulrich's original development of PEF (1983) outlines primarily visual properties that are generally structural in nature (e.g., complexity, structural properties, surface texture, etc.) and more reflective of the *geometry* of a given setting. On the other hand, Kaplan and Kaplan's (1989) descriptions of an RE are more conceptual and abstract (e.g., being away, fascination, extent), and pertain to how one might cognitively relate to a particular setting. Thus, it is possible—although arguably unlikely—that attempts to construct a NRE based strictly on a literal interpretation of stimuli described by PEF or ART might produce two very different environments. In practice, however, researchers in the RE field have little trouble interpreting these two frameworks and testing the restorative potential of natural environments. In fact, many of those environments that are often explored for their restorative potential are relatively common, rather than being particularly novel (e.g., urban and suburban parks or local recreational trails, and not untouched nature reserves). In a way, it is almost as if a NRE is a space *between* spaces, a point reflected by Herzog, Maguire, and Nebel's (2003) statement that "Ordinary natural environments are thought to be especially effective as restorative settings" (p.159).

A survey of the literature reveals a range of environments that have been referred to as a NRE and explored for their restorative potential, such as forested hiking trails or walking trails of varying degrees of "wildness" (e.g., Martens, Gutscher, & Bauer, 2011), open hiking trails (e.g., Hartig et al., 2003), sea and ocean coastlines (e.g., White, Pahl, Ashbullby, Herbert, & Depledge, 2013), and urban green spaces (e.g., Kaplan, 2001). Moreover, virtual environments, presented

in the forms of photographs or videos, have similarly displayed a variety of natural settings (e.g., Berto, 2005; Diette et al., 2003, Ulrich et al., 1991). Interestingly, however, despite an arguably broad range of stimuli, positive restorative outcomes were reported in each of the studies mentioned above. It is difficult, therefore, to describe one *exact* type of natural setting that defines what constitutes an ideal NRE. It is equally difficult to define a finite list or specific degree of natural elements that serve to identify an *ideal* NRE. Instead, the literature supports myriad environments ranging from wild and entirely natural to predominately built space(s) that promote restorative outcomes. The results of the present investigation reflect the ambiguity of what a NRE *must* be, instead reflecting the myriad ways that a NRE *can* be. However, the present data do support the notion that individuals can identify and describe what an NRE means to them and the constituent features that make such an environment restorative.

Likewise, empirical investigations seeking to develop restoration scales have encountered difficulties, resulting in unexpectedly high correlations and factor-analyzed solutions that further complicate the translation of theoretical tenets to practice. First, Hartig, Korpela, Evans, and Gärling (1997) sought to develop the perceived restorativeness scale (PRS) based on the theoretical components of ART (fascination, being away, extent, and compatibility). However, in the initial series of development studies specific to this topic, Hartig, Korpela and colleagues (1997) reported that factor analyses of the validation data *did not* support the anticipated four-factor structure. Instead, these authors reported that the data collected on their 16-item measure was best represented by a two-factor solution. Based on this solution, the subscales for fascination, being away, and compatibility loaded on the first factor (termed general restorativeness), while the extent subscale (termed coherence in the PRS) loaded on the second factor (termed coherence). In subsequent PRS developments, Hartig, Kaiser, and Bowler (1997) revised the wording of some of the original items and added an additional 10 items, resulting in a 26-item PRS. In this follow-up round of validation studies, their data did support the theoretically grounded four-factor solution (Hartig, Kaiser, et al., 1997) which described items for each of the respective ART components as being represented by four independent factors. Coincidentally, a second group with similar intentions described a pair of test construction studies they completed with the intent of developing an ART-based restoration

scale. In their investigation, Laumann, Gärling, and Stormark (2001) reported that data collected from their 22-item questionnaire were best represented by a five-factor solution: fascination, extent, and compatibility each loading on independent factors, and items for being away being split across two additional factors (termed novelty and escape). Collectively, the findings from these three test construction studies suggest that it is difficult to measure the ART components independently, or at least to construct questionnaire items that sufficiently tap into the these independent components.

Additionally, a third group (Herzog et al., 2003) has also endeavoured to develop an ART-based tool that could measure the restorative properties of natural settings. In the development of their questionnaire, Herzog and colleagues (2003) described regression-based analyses that relied on single-item scales for the four ART components and four additional items (openness, visual access, movement ease, and setting care) as predictor variables for two criterion variables (perceived restorative potential and preference). While Herzog and colleagues intended to perform regression analyses that would include all eight predictor variables, unexpectedly high correlations between the components required the authors to modify their approach. The high correlation deemed most concerning for their analyses was found between fascination and extent, thus, prompting the authors to run their various analyses twice—once including fascination, but not extent, and vice versa. Interestingly, Laumann et al., (2001) similarly reported a moderate correlation between fascination and extent in their tool's development study, although it was less strong than the correlation reported by Herzog et al. (2003). Consequently, each of these groups was encountering difficulties in identifying questionnaire items for each of the ART components that could be assessed independently.

Comparatively, the results described in the present investigation are not dissimilar from those reported in these test construction studies (i.e., Hartig, Kaiser, et al., 1997; Hartig, Korpela, et al., 1997; Herzog et al., 2003; Laumann et al., 2001). For example, cluster and principal components analyses of the repertory grid data in the present investigation reflected a primarily two-factor-type solution. In each case, these two general components related to broad interpretations of naturalness and structure. More specifically, NREs in the present investigation were primarily construed relative to their overall naturalness and degree of human influence,



followed by more nuanced judgments relating to the structure and organization of the setting's content. Therefore, based on Kelly's development of PCP (1955) it was suggested that naturalness could act as a superordinate construct, potentially shared across individuals in the current study. As a superordinate construct, naturalness would then subsume subordinate constructs into a hierarchy of personal meaning that may subsequently serve to further define the naturalness of a given setting.

Although Hartig, Kaiser et al. (1997) rejected the two-factor solution for the PRS in their follow-up investigation, the statistically significant two-factor models from both their initial development study (Hartig, Korpela et al., 1997) and their follow-up work (Hartig, Kaiser et al., 1997) are helpful in the present context. For example, each two-factor solution from the PRS studies loaded fascination, being away, and compatibility on one factor, and extent on a second independent factor. Thus, components relating to the content of a setting being: 1) inherently interesting, 2) facilitating a sense of escape, and 3) being congruent with one's intentions, respectively, were grouped together. On the other hand, extent, which relates to the overall patterning and coherence of the setting's content (Kaplan & Kaplan, 1989), was identified separately. Comparatively, many of the constructs from this investigation that grouped within the larger category of naturalness were broadly related to fascination, being away, and compatibility (e.g., [08x]*natural order*\*—*uniform* and [17c]*mundane*—*refreshing*\*, [06x]*not everyday*\*—*familiar / everyday* and [19c]*peaceful*\*—*busy*, and [10x]*safe/good for a walk*\*—*dangerous to walk* and [25c]*unrestricting*\*—*restricting*, respectively). Additionally, constructs relating to broader structural concerns congruent with the coherence of natural patterning and the “whole other world” feeling implied by the extent component (Kaplan, 1995, p.173) emerged (e.g., [02x]*immersion*\*—*still* and [03c]*variegated*\*—*uniform*).

Furthermore, recall that in Herzog et al.'s study (2003) it was fascination and extent that were so highly correlated that the authors could not include them simultaneously in the regression analyses. Again, the results from the present investigation reflect an important relationship between constructs relating to either naturalness or structure, and their potentially dominant role in construing NREs. That is, while the PrinGrid analysis for the treatment group's data suggested a relatively independent third component (structure), it was also suggested from the

cluster analysis that this component could be potentially be subsumed within the broader category of naturalness, indicating a relatively high degree of correlation, as well. Therefore, while the intentions and methodologies differ among this investigation and those that have specifically sought to develop restoration metrics, it is possible that commonalities relative to how NREs are perceived and judged for their potential restorative capacity do in fact exist.

Moreover, the test construction investigations described above (Hartig, Kaiser, et al., 1997; Hartig, Korpela, et al., 1997; Herzog et al., 2003; Laumann et al., 2001) further highlight the complexity of measuring the concept of restoration. Indeed, the components of ART are not unique and independent, but are interrelated processes that work together to promote restoration—the whole being greater than the sum of its parts. Therefore, as interrelated processes in the restorative response, it is expected that these components be at least minimally correlated. In fact, Herzog et al. (2003) discussed this expectation, noting that Kaplan and Kaplan (1989) described how the ART components together are necessary for initiating and sustaining a restorative experience, stating “fascination and extent are mutually supportive” (p.185). This relationship is further reflected in the data discussed by Herzog et al., (2003) and Laumann et al., (2001), both groups reporting notable correlations between fascination and extent. As suggested above, perhaps the more abstract nature of ART’s theoretical components complicate their isolation and measurement, as has been evidenced by the difficulties in constructing psychometrically sound ART-based tools.

In the current investigation, the validity of the theoretical components of ART were not formally explored or tested. As described above, however, difficulties experienced by researchers to develop restoration scales, in addition to accumulating evidence that highlights the broader health- and well-being-based outcomes of nature experiences (e.g., Maas et al., 2006; Mitchell & Popham, 2008; van den Berg et al., 2010), are worthy of brief comment. For instance, the PEF and ART frameworks—each with empirical support—appear to overlap in their scope and definition of an appropriate stimulus and potential response. Therefore, it may be prudent to investigate the foundations of each framework, and to seek to reconcile any potential disparities and/or commonalities between them. In keeping with Hartig et al.’s (2003) suggestion that PEF and ART are complementary, it is necessary to establish whether PEF and ART are, in fact,

independent, complementary, or part of a larger restorative response. Doing so may then permit more focused evaluation of such restorative entities within the context of health and states of illness or disability.

In fact, Kaplan (1995) did propose an integrated theoretical framework that accounted for both stress and directed attention fatigue; however, his integration did not reconcile the theoretical foundations of either theory. Instead, Kaplan argued for the acknowledgement that both stress and directed attention fatigue can exist in isolation or in tandem, and that either can precede the other. Kaplan (1995) concluded that stress reduction and directed attention restoration were “distinct, albeit interacting” outcomes of nature-facilitated restorative experiences.

Unfortunately, however, neither Kaplan’s (1995) integrated framework, nor Hartig et al.’s suggestion of complementary pathways defined by an antecedent condition serve to adequately reconcile the potential disconnect between PEF and ART. Consequently, no theoretical framework currently exists that comprehensively addresses nature-facilitated restoration and accounts for the increasing evidence base of stress, attention, and health outcomes increasingly reported in the RE literature.

It is clear that, predicting and measuring restoration as a construct empirically remains imperfect. This imperfection is ultimately compounded by not only how interrelated processes must work together to facilitate a restorative response, but also because of the myriad ways in which natural environments exist and change. Such inexactness in measuring and predicting restoration was demonstrated in the current investigation through those NREs that were found to be most similar to the ideal NREs described by participants. For example, Elements D and H were found to be the a priori elements that linked highest with the Id in the treatment and comparison groups, respectively, while Element G was the next highest in each group. In gathering and preparing the photographs to be used as a priori elements in this investigation, each of these settings was selected because they displayed water, but also because they also displayed varying terrain, surrounding elements, and exposure. For instance Element D was considered to be an exemplar RE according to PEF and ART; however, some individuals did observe that the uneven riverbank and long grass could present trip and fall hazards. Moreover, Element H does not depict any land in the foreground of the photograph. While this photograph

was taken from the beach, some individuals assumed that they were *in* rather than *near* the lake, which impacted what they thought they could do and accomplish (an echo of ART's compatibility component). And finally, Element G was selected because although it offered a beautiful vista, the shoreline is strictly composed of boulders and broken rock and is home to the real threat of rattlesnakes. Therefore, it was anticipated that G's rugged shore would violate PEF's requirements for lack of threat and including ground cover conducive to movement, as well as potentially *requiring* one to direct his/her attention in order to safely navigate the rocky shore, and further violating ART's requirement of compatibility. Indeed, more than one participant remarked about not wanting to walk along the shore. Thus, while these three elements were most often linked as closest to one's ideal NRE, they are not in every way exemplar NREs as described within the existing literature on PEF and ART (e.g., Ulrich, 1983, 1993; Kaplan & Kaplan, 1989; Kaplan, 1995).

Based on the information provided in the preceding discussion, it is possible that a distinction may exist between being physically present in a given setting versus observing it visually (e.g., via a photograph), and the expected potential to promote restoration. For example, although Element G was construed as being potentially unsafe to walk through (01x, 03c, 10x, 18c, 26c), it was nonetheless construed as a highly restorative environment overall. In the case of 01x (whose grid lacked an *overall* construct), Element G was construed equally to the Id relative to her construct *calming—hustle & bustle*, which was interpreted as the construct in her grid closest to an *overall* construct. Thus, despite these individuals construing Element G as an environment that was potentially unsafe, it was still construed as offering the potential of being restorative. Furthermore, while the majority of individuals wished to be in their Id alone, it could be the case that this preference is a reflection of the Id description phase being a hypothetical exercise. That is, given that one was able to describe their *ideal* NRE, many participants described being alone in relatively wild and/or rugged settings; however, if one were to be physically placed in one of those settings or had to reach such a setting on their own, it might have been the case that such an environment would be overwhelming and, therefore, not restorative.

On the other hand, being alone in just such a setting could be maximally restorative for an individual who enjoys the wild outdoors. Unfortunately, this interpretation is only speculative

given that such questions were not posed to individuals during the interview. Regardless, it was the case that Element G was identified as being potentially unsafe by a few participants, yet still construed by them as being restorative. As such, it could be the case that because the elements were displayed as photographs, one who was unfamiliar or uncomfortable with such a rugged natural place could appreciate its restorative potential without having to actually be present in that space. Similarly, for individuals who are comfortable with such settings, they might be even more likely to construe such an environment as restorative by imagining that they are present in that place, rather than just observing it visually. Moreover, it may be further possible that potentially dangerous environments might be restorative nonetheless when one is able to observe it visually, like an escape, rather than having to be in it physically. It is possible that one's interpretation of the potential restorativeness of any given setting could be influenced by whether or not they are physically in and moving through that space.

Finally, settings that appear to be more wild and rugged (and, thus, potentially more unsafe or threatening) might be good NREs because they provide the opportunity for *reflection*, which is described as an important facet of soft fascination (i.e., different from *hard* fascination and the type of fascination that is described by ART; Kaplan, 1995; Kaplan & Kaplan, 1989). In this investigation, naturalness, wildness, and remoteness were often preferred characteristics of NREs. Again, while it might not be true that such places are ideal to visit and move through (recall ground cover and threat from PEF and compatibility from ART), it might be possible that such environments have a high potential of restoration because they are novel and promote reflection. Therefore, while “ordinary” natural settings are often used in restoration studies and are described as generally good for restoration, non-ordinary natural settings that evoke a greater degree of rugged wilderness might also be very good NREs because they permit new opportunities for reflection and, thus, potentially restoration.

Given the potential that reflection may be a salient component of a restorative response it may, therefore, be necessary to further investigate its role relative to ART and broader restorative experiences. For instance, Kaplan and Kaplan (1989) discussed reflection as being a process afforded to an individual when s/he attends to an environment via fascination. However, reflection itself was not discussed as a necessary component of the restorative response as

defined by ART. Yet, in the current investigation, fascination and reflection may have been important factors in the restorative potential of wild and rugged environments. Further, it was suggested that there could be a distinction between being physically present in an environment versus visually experiencing an environment that further complicates the prediction of a restorative response according to ART. Perhaps visually experiencing rustic and wild environments that permit fascination and reflection, but which may not be sufficiently “compatible,” are perceived as restorative nonetheless. If true, this could be an important consideration when designing spaces with NREs as decoration and design elements. For example, perhaps non-ordinary natural settings would be effective at promoting restoration in health care settings, despite the fact that they might not represent the ideal manifestations of the PEF and ART theoretical frameworks. Consequently, this topic of empirical inquiry could be an important area to consider in future research investigating the restorative potential of natural environments in healthcare settings.

## 4.5 Implications for Oncology Populations

There is no question that promoting health and well-being across the continuum of care in oncology populations (as well as other illness populations) is an important endeavour. While it remains largely unexplored to date, the potential that fostering connections with nature and the natural environment might promote health in those who are ill is just one important avenue to explore. Given the existing theoretical frameworks and a greatly expanding evidence base, the potential to translate evidence from the RE field to oncology and cancer care contexts is promising. However, a single mechanism for delivering a restorative experience is not necessary. Instead, there are myriad ways in which connections with NREs could be fostered based on one’s treatment status. For example, for individuals who are admitted to hospital and/or not ambulatory, window views and interior design and decoration considerations could offer appropriate opportunities for restoration (c.f., Diette et al., 2003; Moore, 1981; Ulrich, 1984). A comparatively greater number of opportunities for restoration are possible for individuals treated as outpatients—through similar design and architectural considerations at the hospital or cancer centre, as well as through potential opportunities to visit or observe NREs at home or in one’s community (c.f., Cimprich & Ronis, 2003; Day, 2008). Opportunities for restoration

are broader still for individuals who have completed treatment and are rehabilitating because they may be able to seek out restorative opportunities in increasingly wild and remote environments, such as conservation areas and national parks. Regardless of exactly *how* restoration may be experienced, the potential to promote health, well-being, and quality of life through simple connections with nature holds great potential for these individuals. Moreover, promoting health and well-being through connections with nature may be even more meaningful for individuals who are gravely ill or receiving palliative care, for whom even small benefits and positive experiences can carry great meaning.

Arguably, the potential restorative psychophysiological response of NREs is relatively small and unlikely to replace primary treatment adjuncts, such as anti-nausea medications or analgesics. Yet, even potentially small restorative responses are not unimportant. That is, the potential restorative response associated with NREs is increasingly emerging as a more generalized phenomenon, rather than specific to improved positive affect, stress reduction, and/or improved directed attention restoration. Instead, the potential for individuals to experience additional and potentially additive restorative outcomes is promising, such as buffering against stress (c.f., van den Berg et al., 2010; Wells & Evans, 2003), improved general health (c.f., Maas et al., 2006, 2009), and post-surgical benefits (c.f., Ulrich, 1984). Thus, given that fostering restorative experiences through contact with nature is generally simple, accessible, and economic (if not free), the potential for even subtle benefits to one's health and well-being is both meaningful and worthy of greater investigation.

Although one of the objectives of this study was to explore whether or not individuals treated for cancer construed NREs differently from healthy individuals, no such differences emerged. The lack of difference in this investigation is an important finding because it suggests that NREs might be commonly restorative across groups of individuals. What's more, these results suggest that one's experiences of cancer and chemotherapy might not influence a fundamental change in one's construing of the restorative potential of natural environments. That is, it may be the case that experiences of ill health and disability do not alter a potentially fundamental preference for natural environments common to us all. Instead, what is likely to be a greater predictor of the restorative potential of an environment is the degree of naturalness, combined with one's own

personal history, experiences, and preferences. While the RE literature is replete with discourse about the potential for a biological and innate preference for particular natural places as an artefact of our evolutionary history, hypotheses that are less dependent on a single origin are likely more accurate at approximating the restorative potential of a given natural environment. For example, both Wilson's description of biophilia being a product of gene-culture co-evolution (Wilson, 1993) and Bourassa's (1990) tripartite paradigm posit interrelated and synergistic processes that account for biological, cultural, and personal processes to influence environmental judgments and responses. Therefore, based on these frameworks, predicting natural environment-facilitated restoration might have innate and biological ties to *basic* types of environments (e.g., those that are natural). However, *absolute* preference and *maximal* restoration might reflect the types of environments one associates with his/her home or culture, as well as their own personal history of interacting with nature and the environment.

Thus, if it is true that fundamental ties to certain types of environments or content exist, then identifying those characteristics or types of natural environments that are maximally restorative for the greatest number of people becomes paramount. What is more, given the infinite variety of ways natural elements can exist, be manipulated, or planned, it becomes important pragmatically to discuss the basic elements of what constitutes a natural restorative environment. Indeed, these basic elements have been identified and articulated previously (Kaplan & Kaplan, 1989; Kaplan, 1995; Ulrich, 1983,1993) and built upon in the literature relative to PEF and ART. Therefore, further expansions in the scope of practice and research in the RE field with an increasing focus on individuals and contexts where maximal health and well-being are not being experienced should be a priority. Given the impact of cancer and its treatment on the individual and his or her family, the potential to improve health, well-being, and quality of life in these individuals by fostering restorative experiences with nature is indeed a worthwhile empirical endeavour. Moreover, fostering restorative experiences with nature and the natural environment may also satisfy an affinity for life and living things that very well may be fundamental to the human condition.



## 4.6 Limitations

Limitations in the current investigation include restrictions inherent to the repertory grid technique itself, the lack of formal hypothesis testing relative to the PEF and ART theoretical frameworks, and the heterogeneous nature of the treatment group. First, the repertory grid technique is different from other methodologies in that it is well suited to inductive analyses that ground results directly in a participant's construct framework. It is for this reason that Kelly (1955) developed the repertory grid technique as a tool for psychotherapy. However, when one is interested in broader, group-level investigations, nuances that were inherent to each individual's grid data are filtered in a sense, when the data are aggregated. Consequently, repertory grid data at the group level do lack a degree of "richness" previously embedded within the grid data. In the same way that a more generic tool or survey is designed to be applicable and generalizable across large groups of individuals, there is a necessary trade-off in the depth of grid data if one is interested in examining group-level data, comparing data among groups, or generalizing findings to a broader population. It is for this reason that participant quotes were added to these analyses, adding back to the data a degree of the personal nuances that emerged from each interview. By linking these reflections of personal perceptions and experience with the more formalized and structured repertory grid data, one may glean additional information that cannot be achieved through composite grids alone.

Second, because the repertory grid technique elicits constructs directly from an individual, and because element ratings are based on these constructs, it is difficult to generate hypotheses a priori and to test them via repertory grids. In the current context, this investigation was borne from an interest in applying RE evidence and knowledge in oncology populations, yet finding a lack of existing evidence to work from. Consequently, it was not clear if empirical evidence in the RE literature was generalizable to a unique population of individuals. As such, the repertory grid technique supported an inductive methodology that permitted investigation of the data in an exploratory and more abstract manner. Thus, the findings from this investigation do not directly support the PEF or ART frameworks in oncology populations. However, these findings do permit one to generate and test hypotheses in the future that posit little to no difference in perceptions of perceived restorativeness, such as investigations based on the PRS (Hartig, Kaiser

et al., 1997) in oncology populations. Indeed, while hypothesis-testing methodologies are important for validating the predictions of theoretical frameworks, they must also be balanced with more exploratory investigations that investigate these same frameworks in novel settings and populations. The present data may provide the first step in approaching the generation and testing of hypotheses related to restorative environments in those with cancer.

Finally, given that the treatment group was relatively small ( $n = 15$ ), and that disease, treatment, and demographic data were highly variable, it is difficult to claim broad generalizability to all individuals treated for cancer. As a result, the external validity of the present data must be viewed with care. Indeed, while an attempt to generalize the current data was not the purpose of this investigation, it is nonetheless important to bear in mind these variations when considering how these findings translate to the broader community of cancer survivors. What is helpful, however, is to consider these findings relative to existing knowledge and evidence in the broader RE literature as support for the prediction that a common restorative response based on NREs potentially exists in the majority of humans. In this way, while the data included herein are not intended to represent every individual diagnosed with and treated for cancer, they further strengthen the argument for exploring the restorative potential of nature experiences to human health and well-being, particularly in the absence of one's optimal health and well-being.

## 4.7 Contribution to Knowledge

The current investigation serves to advance the RE field in new directions by focusing on how current evidence and knowledge may be applied to broader illness populations and healthcare contexts, and oncology populations, in particular. In fact, this investigation joins a limited number of previous investigations exploring the restorative potential of NREs in oncology populations (e.g., Cimprich, 1993, 1998; Cimprich & Ronis, 2003). As the RE field continues to expand into investigations that target restoration from an illness perspective, the findings from the current investigation support the need for future investigations in illness populations based on the contemporary discourse of nature-facilitated restoration. Moreover, the current findings lend support to the prospect of shared interpretations of potential restoration based on NRE experiences also. That is, the current investigation complements the work of Chipeniuk (1995),

as well as the tenets of PEF and ART that predict restorative responses across individuals. Overall, the current study advocates for expanding RE-related investigations beyond highly controlled laboratory based studies to apply current evidence in settings and with populations that stand to benefit more from restorative experiences than young and healthy individuals.

## 4.8 Directions for Future Research

Based on the results from the present investigation, there are three potential areas of research that deserve attention in contemporary RE research and practice: immersion and companionship, naturalness, and healthcare contexts. First, the emergence of the immersion and companionship themes from the ideal NRE analysis revealed that individuals vary widely in their preference for what is ideally restorative. Importantly, the differences between Ids that were surrounded vs. on the margin, or solitary vs. social indicate that there are myriad factors that may contribute to a maximally restorative experience. Investigating such personal nuances (i.e., ruggedness vs. easiness, exposure vs. protection, direct sun vs. shade, etc.) in determining the ideal conditions for restoration may be best suited to the exploratory nature of qualitative enquiries at the outset.

Second, the results of this study indicate that the degree of naturalness of any given setting is likely an important, if not dominant, predictor of the potential for restoration. Considering the tenets of PEF and ART, as well as the focus on natural environments as ideal settings for restoration in the RE literature, these results are in keeping with contemporary research and practice. However, one particularly interesting finding from the current study was that settings that depicted environments that are potentially dangerous to navigate were identified as being very good restorative places. Given that these NREs were experienced via photographs, rather than one physically being in and moving through these settings, it may be possible that the characteristics of a NRE as defined by PEF and ART (especially ground cover and threat, and compatibility, respectively) are less rigid and open to individual interpretation. Therefore, another particularly interesting avenue of future research would be to explore whether the restorative potential of a given natural environment changes depending on whether it is experienced physically or visually. Such investigations may provide new insights into how NREs

are perceived and how best to deliver and foster restorative experiences in various contexts, such as physically or virtually, and based on the needs and desires of the target audience.

Third, and finally, the RE field is one that is emerging with new projects and new evidence being constantly described in the literature. Yet, the RE field remains relatively dominated by research that is often laboratory based, is nearly entirely comprised of healthy young adult student samples, and is predominately conducted within the context of environmental psychology (c.f., Bowler et al., 2010). While there have been investigations that have explored the potential restorative effects of nature experiences in hospital and healthcare settings (e.g., Cimprich, & Ronis, 2003; Diette et al., 2003; Ulrich, 1984), such contexts remain relatively unexplored. Ultimately, there exists the potential that active efforts to foster psychophysiological restoration in individuals who are experiencing ill-health and disability might promote more generalized health effects relative to well-being and quality of life. Therefore, to further develop an understanding of restorative experiences during times of ill health and disability, it is necessary that investigations in the RE field expand in scope and purpose. Indeed, there exists the potential that individuals experiencing ill-health and disability secondary to disease and treatment may have the most to gain and consequently, opportunity to exploit nature to benefit those who are ill may carry substantial value.

## 4.9 Conclusion

Overall, no differences based on health or demographic factors emerged as important to how individuals construe natural restorative environments in this investigation. Instead, differences in construing NREs were based on personal experience(s), and the potential for restoration was best predicted by the element of naturalness. Indeed, there is broad scope of natural environments that are considered ideally restorative, and the differences along this continuum are underscored by important nuances and individual differences based on one's life experiences. Importantly, however, the findings of the present study also highlight that while not all natural environments are maximally or ideally restorative, they are nonetheless construed as restorative. Thus, although there are multiple factors that are personally embedded in our own unique histories, it is likely that at some level of our being we share a fundamental preference for

nature and its beauty. Therefore, if we are *of* nature, and if fostering our connections with nature and the environment can foster health and well-being within us, then we are behooved to value and protect nature, to reacquaint ourselves with its mystery and magic, and to ensure that it is accessible to all.

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## Appendix A

### Glossary

**ART** “attention restoration theory” (Kaplan & Kaplan, 1989; Kaplan, 1995); an environmental psychology theory that predicts directed attention restoration based on an experience with a restorative environment

**construct** from personal construct psychology, a bi-polar psychological device by every individual to perceive and judge an element, and to predict future outcomes of similar elements

**construe** from personal construct psychology, the act of using a construct or construct framework to perceive and judge an element

**element** from personal construct psychology, the person, event, stimulus, or phenomenon that is being construed by an individual

**NRE** natural restorative environment; a natural environment or setting, specifically, predicted to promote restoration via affect, physiologic, or attention pathways

**PEF** “psychoevolutionary framework” (Ulrich, 1983, 1993); an environmental psychology theory that predicts stress reduction and positive emotions in an already stressed individual upon experiencing a restorative environment

**range of convenience** the range or universe of relevant elements for which a set of constructs is meaningfully applicable for any given individual

**RE** restorative environment; an environment or setting predicted to promote restoration via affect, physiologic, or attention pathways

**repertory grid** a data matrix comprised of construct ratings for elements elicited during an interview based on personal construct psychology

## Appendix B

### Confirmation of Research Ethics Approval



Research Ethics

Use of Human Participants - Ethics Approval Notice

Principal Investigator: Dr. Philip Doyle  
 File Number: 102147  
 Review Level: Delegated  
 Approved Local Adult Participants: 60  
 Approved Local Minor Participants: 0  
 Protocol Title: Construing Restorative Environments in Individuals Treated for Cancer - 18703E  
 Department & Institution: Health Sciences/Communication Sciences & Disorders, Western University  
 Sponsor:  
 Ethics Approval Date: February 19, 2013 Expiry Date: December 31, 2013  
 Documents Reviewed & Approved & Documents Received for Information:

| Document Name          | Comments   | Version Date |
|------------------------|--|--------------|
| Revised Study End Date | The study end date has been extended to December 31, 2013 to allow for project completion. |              |

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the University of Western Ontario Updated Approval Request Form.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

The Chair of the HSREB is Dr. Joseph Gilbert. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

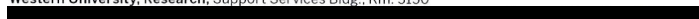


Ethics Officer to Contact for Further Information

|                   |             |                 |
|-------------------|-------------|-----------------|
| Janice Sutherland | Grace Kelly | Shantel Walcott |
|-------------------|-------------|-----------------|

*This is an official document. Please retain the original in your files.*

Western University, Research, Support Services Bldg., Rm. 5150



## Appendix C

### Semi-Structured Interview Guide

1. General introduction and welcome.
2. Consent procedure:
  - a. Inquire if individual has read the Letter of Information (LOI) as provided in advance via email or from health care professional or from participating centre.
  - b. Provide LOI and ask individual to read letter and sign letter. Ask if s/he has any questions about the letter, its contents, or the study. Also have them complete the demographic form.
3. General introduction to study and task.
  - a. Inform the individual that the task requires them to make judgements about images of various natural spaces, and that the overarching theme of the interview is “natural restorative environments,” however, s/he would like to define that.
  - b. Instruct the individual that: “When we begin, I am going to show you three images and I would like you to tell me an important way that two of the images are similar, and thereby different than the third. The words you use to describe the similarity and difference will then be used as anchors of a scale, on which I am going to ask you to rate each photograph. We will repeat this process until you are no longer able to give identify “new” similarities and differences. I am going to take a lot of notes, and I am going to ask a lot of questions, but I am interested in your thoughts, your words, and your perceptions. At no point do I want to put “words in your mouth,” but I will ask questions, rephrase your words, and offer suggestions to make sure I understand what you mean.”
  - c. Before beginning the grid task, inform the individual that in addition to the 10 photographs, there will be one additional setting based on their “imagined ideal”



natural restorative environment. Have them describe this place, and let them know that it can be a real or imaginary place, and that it can be any type of place as long as it contains natural features of some kind. Have them think about and describe this place, asking them to think in terms of their five senses. If they are describing a place dynamically, or as if they are walking through it, ask them to think about being in one place looking in one direction, and describing what they can see from there. Encourage them to draw their ideal place using the whiteboard and markers. Once they have described it, make sure they remember to keep this place active in their imagination as they will keep coming back here to make judgements.

4. Completing the repertory grid.
  - a. Instruct the participant that there are random sets of three images. Display the first triad, and ask him/her “tell me an important way that two of these images are similar, and thereby different than the third.” When s/he has selected the two similar images, ask as many questions as needed to understand the construct in its purest form. Ask how the third setting is different (not opposite), and then have them write the similarity on the left side of their chart and the difference on the right side. Then, using the scale diagram, have them rate the first three photos on a scale of 1 – 7, where one is most like the similarity as opposed to 7, which is most like the difference. Once they have rated the triad, have them rate the remaining elements.
  - b. When complete, ask them if there are any questions, and continue with the next triad. Inform the participant that you will now repeat this procedure throughout the interview until they are no longer able to offer new similarities and differences, which is ultimately the point of the task.
5. When the participant is no longer to offer novel constructs, have them complete the last construct “overall restorative – overall not restorative,” and then debrief, answering any questions and filling them in on what you are doing and why.

## Appendix D

### Sample Grid and Overview of Procedure

1. Introduction, informed consent, demographic questionnaires.
2. General description of elicitation and rating task with example.
3. Elicitation of ideal NRE.
4. Presentation of random triad and construct elicitation, followed by discussion.
5. Rating of all elements based on recently elicited construct.
6. New random triad and construct elicitation. This process continued until participant skips two consecutive triads or is unable to elicit a novel construct.
7. Debriefing, questions, and conclusion of interview.

|                     | A                 | B | C | D | E | F | G | H | I | J |  |                         |
|---------------------|-------------------|---|---|---|---|---|---|---|---|---|--|-------------------------|
|                     | ← as opposed to → |   |   |   |   |   |   |   |   |   |  |                         |
| sim                 |                   |   |   |   |   |   |   |   |   |   |  | diff                    |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
|                     |                   |   |   |   |   |   |   |   |   |   |  |                         |
| overall restorative |                   |   |   |   |   |   |   |   |   |   |  | overall not restorative |
|                     | ← as opposed to → |   |   |   |   |   |   |   |   |   |  |                         |

Figure. Sample blank repertory grid.

## Appendix E

### Positioning Statement

In keeping with the tenets of constructive alternativism and the nature of the PCP framework (Faber Taylor & Kuo, 2009; Kelly, 1955), I believe it important to acknowledge my role in this research process. In PCP, the sociality corollary describes the underlying interpretive social processes involved when one tries to construe the constructions of another. This process is fundamental to each of the interviews I conducted. Thus, it is important to acknowledge my role in how data for this dissertation were *co-created* through my discussion with each participant and subsequently analyzed and presented. Practicing *reflexivity* can help me acknowledge this role and make explicit my own personal history and biases, as well as ensure greater transparency in this dissertation. Reflexivity describes a process of critical self-awareness practiced by a researcher to realize one's own history, assumptions, and biases that cannot be separated from the research processes, and to acknowledge these in presentation of the research as a measure of transparency (Finlay, 2002). It has been advocated previously by Neimeyer (2002) when using the repertory grid technique, as well as being fundamental to conducting transparent, ethical, and rigorous research in the qualitative research community (e.g., Finlay, 2002; Macbeth, 2001). Thus, since constructivist ontological and epistemological perspectives inform constructive alternativism and PCP, and further to acknowledge my role in the research I describe here, I include the following piece about my own attitudes and perceptions relative to human-nature relationships.

Over the last eight years I have developed a strong affinity for nature and the natural environment. As a child I lived across the street from a small conservation area. It was the setting of endless weekend adventures, as well as serving as my route to school. As a teenager I walked through "the marsh" for respite from the chaos of school and teenage life. As an adult it was a place I walked through to spend time with my parents, eyes peeled for deer. I am the product of six years in Scouts Canada programs, annual trips to Algonquin Park with my family, the hassles of late night bear hangs, and the strain of a flexed neck earned while navigating a canoe through the bush. I have laughed and I have cried among the trees.

Further, nine years of summer and part-time jobs have included horticulture, landscaping, and arboriculture. I know how to plant a tree, and I know how to fell one. I have always sought outdoor work, and even during the hardest, hottest, and/or wettest days I reaped comfort from working with my hands on the land. I do not practice religion, but I practice a personal spirituality with nature, most pronounced when I am isolated within it. I am a *biophile*.

I have come to be interested in exploring human-nature-health relationships through marrying my passion for nature with my desire to teach and research. I struggle with balancing my desire to idealize and romanticize biophilia—wishing to believe that we all are innately drawn to nature—against my conscious drive for critical scientific enquiry. The nature vs. nurture debate, and believing in individual differences, social processes, and emergent phenomena add further complexity to my conceptualization of, and value for positive human-nature relationships.

This reflection is not trivial; I am declaring my position as a researcher and acknowledging the “lens” through which I have conceptualized this project, conducted the interviews, interpreted the findings, and composed this work. Indeed, it is my interpretation of PEF, ART, and the environmental psychology literature that informed my selection of stimuli, and through my own construct framework that I probed each participant’s perceptions and judgments. Consequently, it was through co-constructing meanings that each participant and I came to a shared understanding of the constructs s/he was describing, as well as the pace and direction in which I directed each interview (Jankowicz, 2004). Thus, it was through my own experiences and feelings about nature and the environment that I built a rapport with each individual and endeavoured to interpret his/her constructions. In order to minimize my role and influence during each interview, I sought to instil ownership in each individual over the interview process. Specifically, I advised each individual that I was interested in his/her *own* thoughts, perceptions, and judgements, and that while I would ask many questions and possibly offer suggestions, that I wanted them to use their own language and to ensure that I understood what they were discussing before we moved on. As well, I relied on the standard pattern and technique of the repertory grid to guide the interviews, particularly when they veered off course.

Overall, each individual's grid is a mathematical representation of how s/he conceptualized each construct scale, which itself was the product of a co-construction between that individual and myself. To the best of my ability, I tried not to influence the content or direction of the interviews beyond the standard procedures, my interview guide, and the elements I had selected. The data and the interpretations included in this treatise reflect the personal construct frameworks of each individual who participated in this investigation, but have been construed through my understanding of each individual's data. These data were elicited through shared experiences and social processes in which I participated, but which I am confident are a rigorous representation of the ways in which these individuals construed natural restorative environments to me at the time of their interview.

## Appendix F

### Letter of Information



Western  
HealthSciences



London Health Sciences Centre

#### Letter of Information and Consent Form

Study title: *Construing Restorative Environments in Individuals Treated for Cancer*

Study Investigators: Adam M.B. Day, M.Sc., Ph.D. Candidate  
Dr. Kevin Fung, M.D., FRCS(C)  
Dr. David Palma, M.D., M.Sc., Ph.D.  
Dr. Philip C. Doyle, Ph.D.

The University of Western Ontario  
[Redacted]

#### **Introduction**

This letter contains information to help you decide whether or not to participate in this research study. It is important for you to understand why the study is being conducted and what it involves. Please read this letter carefully and feel free to ask questions if anything is unclear or there is something you do not understand.

You are being invited to take part in this study for one of two reasons: 1) either because you are currently receiving or have recently completed receiving chemotherapy for a cancer diagnosis, or 2) because you have not been treated for cancer in the past and you are within 5 years of age of someone who is already enrolled in this study who has been treated for cancer.

#### **Purpose of Study**

This study will include two groups of individuals: one group of individuals who have been treated for a cancer diagnosis ("Treatment Group"), and one group of age-matched peers who have not been treated for cancer ("Comparison Group"). The purpose of this study is to explore how individuals who are being treated for, or who have recently completed treatment for cancer make judgments about nature and the natural environment. Judgements of individuals treated for cancer will be compared with judgements made by individuals who have not been treated for cancer.

#### **Inclusion Criteria**

"Treatment Group": If you have received a cancer diagnosis for which you are currently, or within the last 12 months have completed chemotherapy, and if you are 18 years of age or older and can have a conversation in English you can choose to participate in this study.

"Comparison Group": If you have not been treated for cancer in the past, and if you are 18 years of age or older and can have a conversation in English you can choose to participate in this study.

#### **Exclusion Criteria**

"Treatment Group": If your current treatment is considered palliative, if do not feel comfortable having a conversation lasting more than 60 minutes, or if you have uncorrected vision problems you should choose not to participate in this study.

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Initials \_\_\_\_\_

*Construing Restorative Environments in Individuals Treated for Cancer (#18703E)* Page 1 of 4

“Comparison Group”: If you have been treated for cancer in the past, if you do not feel comfortable having a conversation lasting more than 60 minutes, or if you have uncorrected vision problems you should choose not to participate in this study.

#### **Description of the Research**

If you choose to participate in this study you will be asked to take part in one interview with Mr. Day. During this interview you will be asked to make judgements of photographs of natural scenes and have a discussion about how you came to make those judgments. In some cases, you may be asked to participate in a follow-up interview.

In general, primary interviews are expected to last approximately 90 minutes, but could last anywhere from about 60 minutes to 120 minutes or longer. The length of each interview will depend on the nature of the discussion between you and Mr. Day. If a follow-up interview is required, it is anticipated not to last more than one hour.

Interviews are intended to take place in a setting that is comfortable for you. You may choose to have the interview conducted in your home, a public setting, a private office or laboratory at the University of Western Ontario, or somewhere else that you feel comfortable. In some cases, Mr. Day may ask if you would like to conduct an interview in a public garden or park. Interviews will be audio recorded, and Mr. Day will take notes during meetings with you.

#### **Risks & Harms**

There are no known or anticipated physical risks or discomforts associated with completing this study. However, it is possible that you might experience emotional or spiritual discomfort or distress when thinking about nature and reflecting on your cancer diagnosis and treatment. You may end an interview whenever you choose.

#### **Benefits**

You may not benefit directly from participating in this research project. However, your participation could contribute to a greater understanding of human-nature-health connections with potential benefits to future individuals diagnosed with cancer, as well as healthcare and society in general.

#### **Voluntary Participation**

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions, or withdraw from the study at any time with no effect on your current or future health care. You will not be compensated for your participation in this research.

#### **Refusal to Participate & Discontinuing Participation**

The decision to participate is yours to make. If at any time you wish to discontinue your participation you may do so without penalty. If at any time before the completion of the study you wish to discontinue or withdraw your participation, please contact Mr. Day.

Your data will be completely de-identified at the completion of the study and, therefore, after this time you will not be able to withdraw your data because it will be indistinguishable from other participants' data.

### **Participation in Concurrent Research**

If you are currently participating in any other research studies, it is important that you notify Mr. Day and the contact person for the other study you are participating in.

### **Confidentiality**

For the purposes of arranging and conducting interviews, you will be required to provide your address and contact information. You may choose to have the interviews conducted at your home, or at another location you are comfortable with. Your identity and personal information will be coded and known and accessible only by Mr. Day and Dr. Doyle. In addition, representatives of The University of Western Ontario Health Sciences Research Ethics Board may contact you or require access to your study-related records to monitor the conduct of the research.

All of your personal data will be stored electronically in a password protected and encrypted file and as a hard copy in a locked filing cabinet at a locked laboratory at the University of Western Ontario. This locked filing cabinet is only accessible to Dr. Doyle and Mr. Day. However, Mr. Day will be required to travel between the location where the interview is completed and the laboratory at UWO with your personal data. Any electronic data will be encrypted during this time, while hard copies will remain on Mr. Day's person. Also, a unique identifier will be used instead of your name on all study materials and instruments to protect your confidentiality. Once the study is complete, all of your personal data will be securely deleted and destroyed, and your data will not be identifiable. Your name will not be used in any way other than to communicate with you, and information that discloses your identity will not be released or published. Please note, any information shared via email will be protected to the best of our ability; however, email is not a secure form of communication.

If you have been enrolled in this study and/or had interviews conducted in a country other than Canada your information will be transferred digitally across an international border. As such, Border Security can ask to see digital information contained on the laptop recording system (encrypted or otherwise). While your information will be coded and known only to the investigators, this potential privacy risk must be brought to your attention.

### **Contact Information**

If you have any questions about your rights as a research participant or the conduct of the study you may contact Adam Day, Co-Investigator, [REDACTED], or Dr. Philip Doyle, Principal Investigator, [REDACTED]. If you would like to receive a copy of the overall results of this study following completion, please contact Adam Day or Dr. Doyle. If you have any questions about your medical treatment, please contact the physician responsible for your treatment.

If you wish, you may also contact Dr. David Hill, Scientific Director, Lawson Health Research Institute [REDACTED] if you have any questions about this research relative to LHSC, or The Office of Research Ethics [REDACTED] if you have any other questions about this research.

### **Waiver of Rights**

You do not waive any legal rights by signing the consent form.

**This letter and a copy of the consent statement are yours to keep.**



**Consent Statement – Investigator's Copy**

Study title: *Construing Restorative Environments in Individuals Treated for Cancer*

Study Investigators: Adam M.B. Day, M.Sc., Ph.D. Candidate  
 Dr. Kevin Fung, MD, FRCS(C)  
 Dr. David Palma, M.D., M.Sc., Ph.D.  
 Dr. Philip C. Doyle, Ph.D.

The University of Western Ontario  
 [REDACTED]

---

I have read the Letter of Information, have had the nature of the study explained to me and agree to participate. All questions have been answered to my satisfaction.

---

Participant's Signature

---

Investigator's Signature

---

Participant's Name

---

Investigator's Name

---

Date

---

Date

Contact information:

Adam MB Day: [REDACTED]

Dr. Kevin Fung: [REDACTED]

Dr. David Palma: [REDACTED]

Dr. Philip C. Doyle: [REDACTED]

## Appendix G Recruitment Poster

# Study Participants Wanted

for interviews exploring judgments about nature and the natural environment.

If you are currently receiving chemotherapy treatment for your cancer, or you have completed chemotherapy within the past 18 months you are invited to participate.

If interested, please contact:

Adam Day, M.Sc.

Dr. Philip Doyle, Ph.D.



Adam Day is a Ph.D. student in Rehabilitation Sciences at the University of Western Ontario exploring how individuals treated for cancer think about nature and the natural environment. This study will explore how you perceive natural environments, and which natural environments you consider to be restorative.



UWO Research Ethics Approval # 18703E

## Appendix H

### Demographic Information Questionnaire

#### Demographic Information Survey

Please read the following questions carefully and provide answers as accurately as possible. For multiple choice options, please place an "X" next to all choices that apply to you. If no suitable options exist, please use the space provided to explain. If there is any additional information that you feel is important to report regarding your experience with distress or your quality of life, please explain using the back of these pages.

Age: \_\_\_\_\_ years & \_\_\_\_\_ months

Sex: Male / Female

Site of cancer diagnosis: \_\_\_\_\_ Time since your diagnosis: \_\_\_\_\_ years & \_\_\_\_\_ months

#### Occupational status:

|                    |                        |           |
|--------------------|------------------------|-----------|
| Working: Full-time | Working: Part-time     | Volunteer |
| Retired            | On disability benefits | Other     |

If "other", please specify: \_\_\_\_\_

#### Marital status:

|         |            |          |
|---------|------------|----------|
| Married | Separated  | Divorced |
| Widowed | Common-law | Single   |

#### If known, what is/was your stage of cancer?

|           |          |
|-----------|----------|
| Stage I   | Stage II |
| Stage III | Stage IV |

#### What is your current treatment status?

|                                 |                                |                     |
|---------------------------------|--------------------------------|---------------------|
| Currently waiting for treatment | Currently undergoing treatment | Completed treatment |
|---------------------------------|--------------------------------|---------------------|

If treatment has been completed, please specify date of completion if known:

\_\_\_\_\_

#### If you have undergone treatment, what type of treatment have you received? (Check all that apply)

|              |                                      |
|--------------|--------------------------------------|
| Surgery      | Radiation Therapy                    |
| Chemotherapy | Chemoradiation (combination) Therapy |

**Highest level of education completed:**

|                                       |  |                   |  |                      |  |
|---------------------------------------|--|-------------------|--|----------------------|--|
| Less than high school                 |  | Some high school  |  | High school graduate |  |
| Some college/post-secondary education |  | College graduate  |  | Apprenticeship       |  |
| Trade School                          |  | Bachelor's degree |  | Master's degree      |  |
| Professional degree                   |  | Doctorate         |  | Other                |  |

If "other", please specify: \_\_\_\_\_

**Household income (optional):**

|                         |  |                     |  |                       |  |
|-------------------------|--|---------------------|--|-----------------------|--|
| Less than \$25,000      |  | \$25,000 – \$40,000 |  | \$40,001 – \$55,000   |  |
| \$55,001 – \$70,000     |  | \$70,001 – \$85,000 |  | Greater than \$85,000 |  |
| Would prefer not to say |  |                     |  |                       |  |

**Do you consider yourself to be an "outdoors" type of person?**

|     |  |          |  |    |  |
|-----|--|----------|--|----|--|
| Yes |  | Somewhat |  | No |  |
|-----|--|----------|--|----|--|

**What value, if any, do you place on the natural environment and your relationship with it?**

|                 |  |          |  |
|-----------------|--|----------|--|
| None            |  | A little |  |
| Some / moderate |  | A lot    |  |

**Please check any activities that you participate in, even if infrequently.**

|               |  |                           |  |                       |  |
|---------------|--|---------------------------|--|-----------------------|--|
| Camping       |  | Gardening                 |  | Nature walks / Hiking |  |
| Bird watching |  | Visiting parks or gardens |  | Other                 |  |
| None          |  |                           |  |                       |  |

If "other", please specify: \_\_\_\_\_

**If you indicated any of the activities above, about how often do you participate?**

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*Construing Restorative Environments in Individuals Treated for Cancer*

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|                         |  |                              |  |   |  |
|-------------------------|--|------------------------------|--|---|--|
| 5 – 7 times per week    |  | 3 or 4 times per week        |  | 1 – 2 times per week                      |  |
| Less than once per week |  | Only once or twice per month |  | Only once or twice every couple of months |  |

## Appendix I

### Basic Interpretation of the Cluster and PrinGrid Analyses

#### Basic Interpretation of a Cluster Analysis

The Focus algorithm in Rep 5 computes a hierarchical cluster analysis, sorting constructs and elements based on their degree of similarity with other constructs or elements, respectively. The higher the degree at which two constructs or elements link, the more similarly they are construed according to an individual's ratings (Gaines & Shaw, 2009a; Jankowicz, 2004). The “dendrogram” included in each plot displays lines which link any given item to the next most similar item. Items are linked, and then clustered into groups according to their degree of relative similarity. The point at which two lines intersect indicates the degree of similarity of those items as a percentage of the maximum possible match (Gaines & Shaw, 2009a).

In some cases, an “R” may be placed next to a construct label, indicating that those construct ratings have been reflected. In such a case, construct ratings have been reflected so that the hierarchy of ratings are interchanged. Thus, on a seven-point scale, ratings of 1, 2, or 3 are reflected as 7, 6, or 5, respectively, where 4 is the mid-point and remains unchanged. Reflecting construct ratings retains the relative difference between ratings, such that a rating of either 1 or 7 still represents a difference of 6 units. In a repertory grid, it is the relative difference between ratings that is meaningful, and not the ratings themselves (Jankowicz, 2004). Moreover, although the poles and ratings along a construct have been reflected, there is no change in interpreting the meaning of those ratings. For example, an element rating of 1 on a construct *hot—cold* implies that element is construed as hot. However, if the poles are reflected and the construct is written *cold—hot*, the rating of 1 is reflected as a 7, meaning the element is still construed as being hot. Overall, cluster analyses provide a simple visual representation of grid data so that ratings across constructs and elements can be more easily interpreted and explored (Fransella et al., 2004; Jankowicz, 2004).

## Basic Interpretation of a PrinGrid Analysis

The graphic plot produced by computing a PrinGrid analysis in Rep 5 locates constructs and elements in a perceptual space that is defined by components plotted as axes. The PrinGrid analysis computed in Rep 5 is based on Slater's (1964) original algorithm for computing a principal components analysis of the grid data (Gaines & Shaw, 2009a; or more correctly, a singular value decomposition, Fransella et al., 2004). The PrinGrid graphic plot reflects the component extractions and construct loadings which can also be derived by computing a PrinGrid analysis. When displayed, these data display the relative loading of each construct on every extracted component (Gaines & Shaw, 2009a).

In the graphic, constructs are plotted according to their relationship to each component. The angle between any given construct and axis (i.e., component) reflects the degree to which that component accounts for that construct. For example, a construct that lies directly along an axis (i.e., component) is maximally related to that component and, therefore, minimally related to the other component(s) in the plot. Thus, orthogonal relationships (i.e., perpendicular) plotted in the grid reflect maximum independence of those items, while the relative length of each construct reflects the variance of ratings on that construct (Jankowicz, 2004). Constructs and elements are displayed in a PrinGrid based on their statistical correlations and are plotted such that groupings of items reflect similarity. Thus, PrinGrid plots are helpful for uncovering deeper relationships and implications of meaning than can be derived from a basic grid or a cluster analysis.

## Appendix J Copyright Permission

7/16/13

Gmail - FW: WW Norton - Permissions Inquiry



Adam Day [REDACTED]

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**FW: WW Norton - Permissions Inquiry**

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To: Adam Day [REDACTED]

Fri, Apr 26, 2013 at 11:10 AM

Dear Adam

**Re: 218 words in 'Psychology of Personal Constructs Vol. 1'**

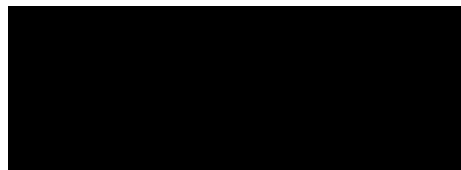
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## Curriculum Vitae

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| <b>Name:</b>                                 | Adam Michael Bryson Day  |
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|                | <p>Bechard, D., Day, A.M.B., Dufour, S., Dzioba, A., McCabe, C., Rasmussen, S., &amp; Doyle, P.C. (2010). How medical students conceptualize health and disability: implications for interprofessional practice and education. <i>Journal of Research in Interprofessional Practice and Education</i>, 1(2). Available from <a href="http://jripe.org/index.php/journal/article/view/10">http://jripe.org/index.php/journal/article/view/10</a></p> <p>Doyle, P.C., Day, A.M.B., Whitney, H.W., Myers, C., &amp; Eadie, T.L. (2009). The utility of symptom checklists in long-term postlaryngectomy follow-up. <i>Journal of Speech-Language Pathology and Audiology</i>, 33(4), 174-182.</p>  |
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